ANTIMICROBIAL STEWARDSHIP

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Spectrum Health, Department of Pharmacy
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Learning Objectives

1. Understand what antibiotic stewardship is and why it’s needed
2. Learn practical steps for antibiotic stewardship implementation in their work
3. List resources available for their work in antibiotic stewardship

Disclosures

- No personal or professional disclosures to announce

From The Start…

"The microbes are educated to resist penicillin and a host of penicillin-fast organisms is bred out.... In such cases the thoughtless person playing with penicillin is morally responsible for the death of the man who finally succumbs to infection with the penicillin – resistant organism. I hope this evil can be averted."

- Sir Alexander Fleming

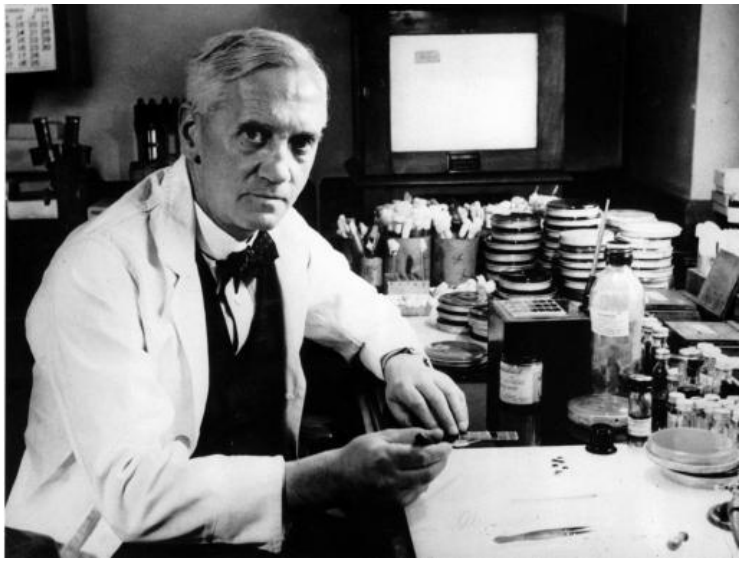


Image available from: https://www.awesomestories.com/asset/view/Alexander-Fleming-and-Penicillin-The-Wonder-Drug-

Resistance of *Pseudomonas aeruginosa* to Carbapenems

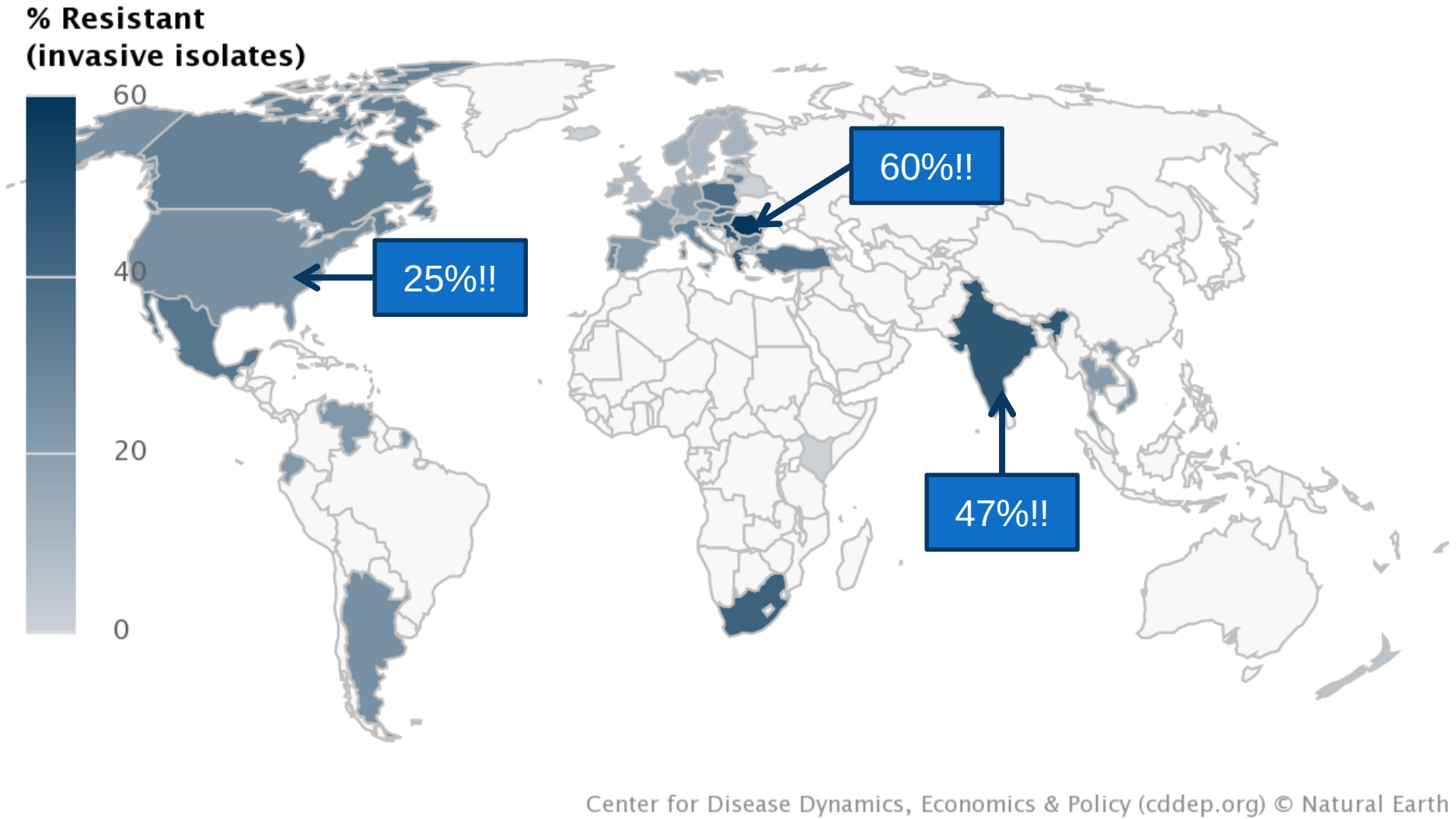


Image available from: https://resistancemap.cddep.org/AntibioticResistance.php

Resistance of *Acinetobacter baumannii* to Carbapenems

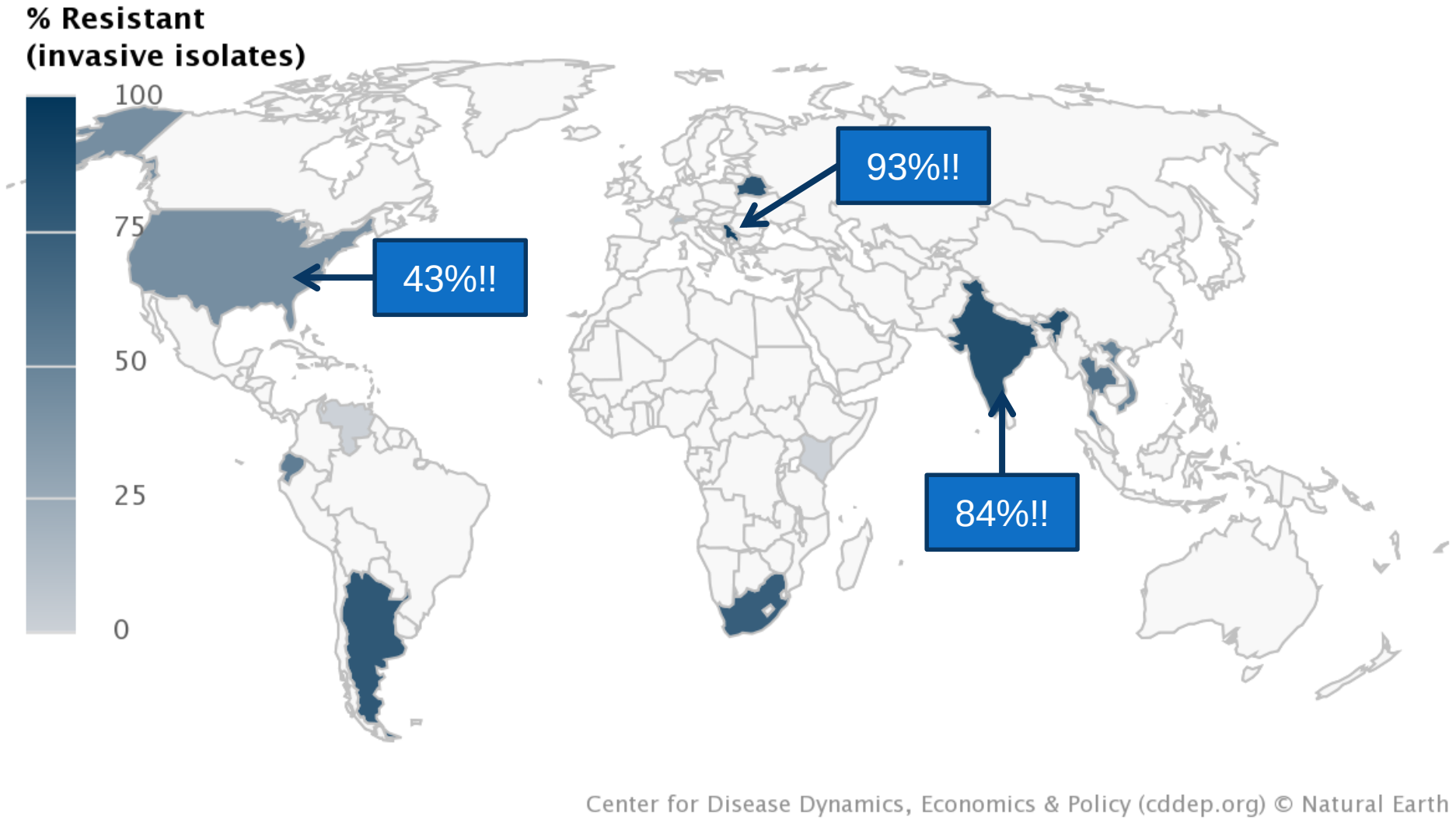
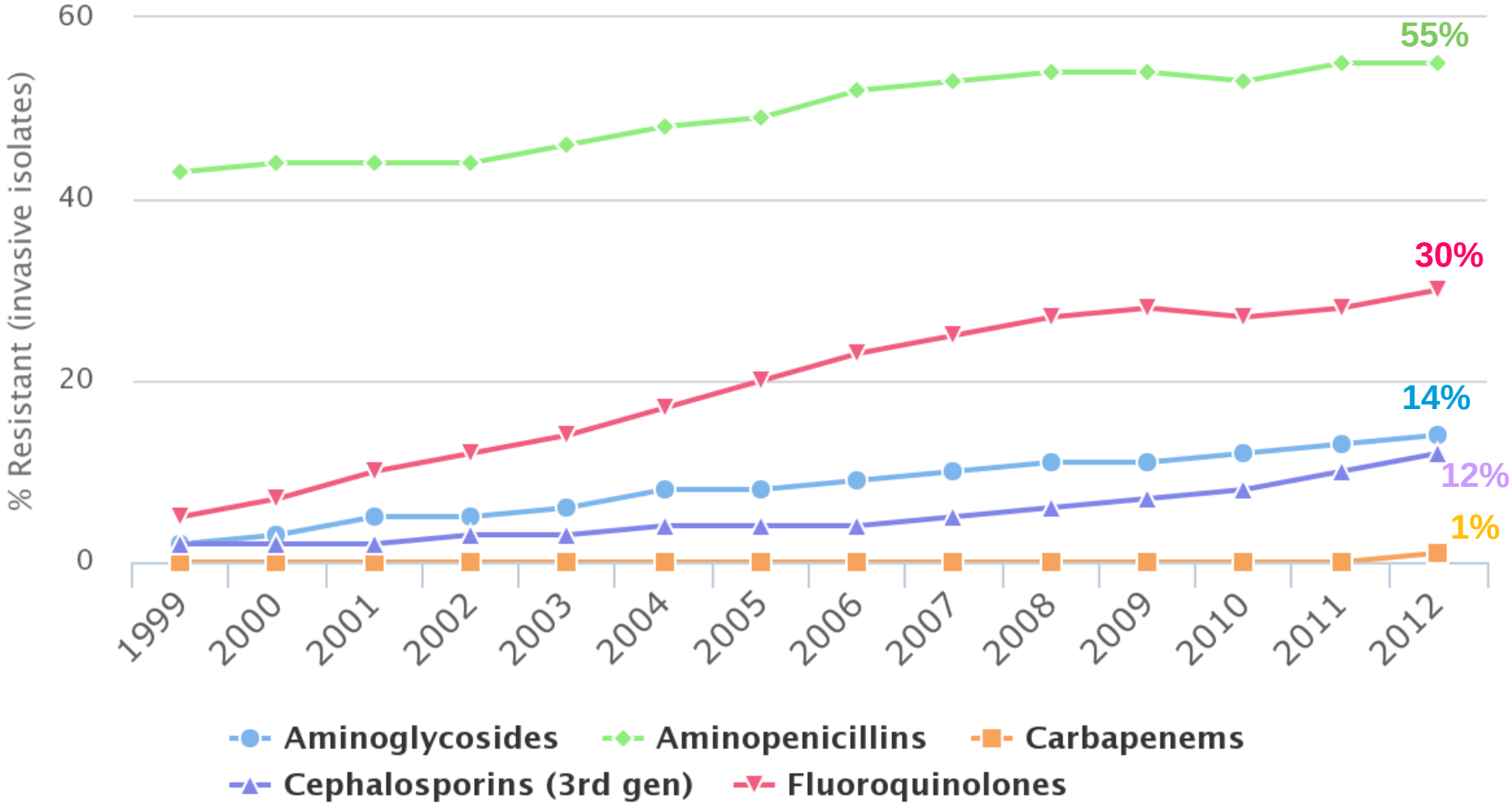


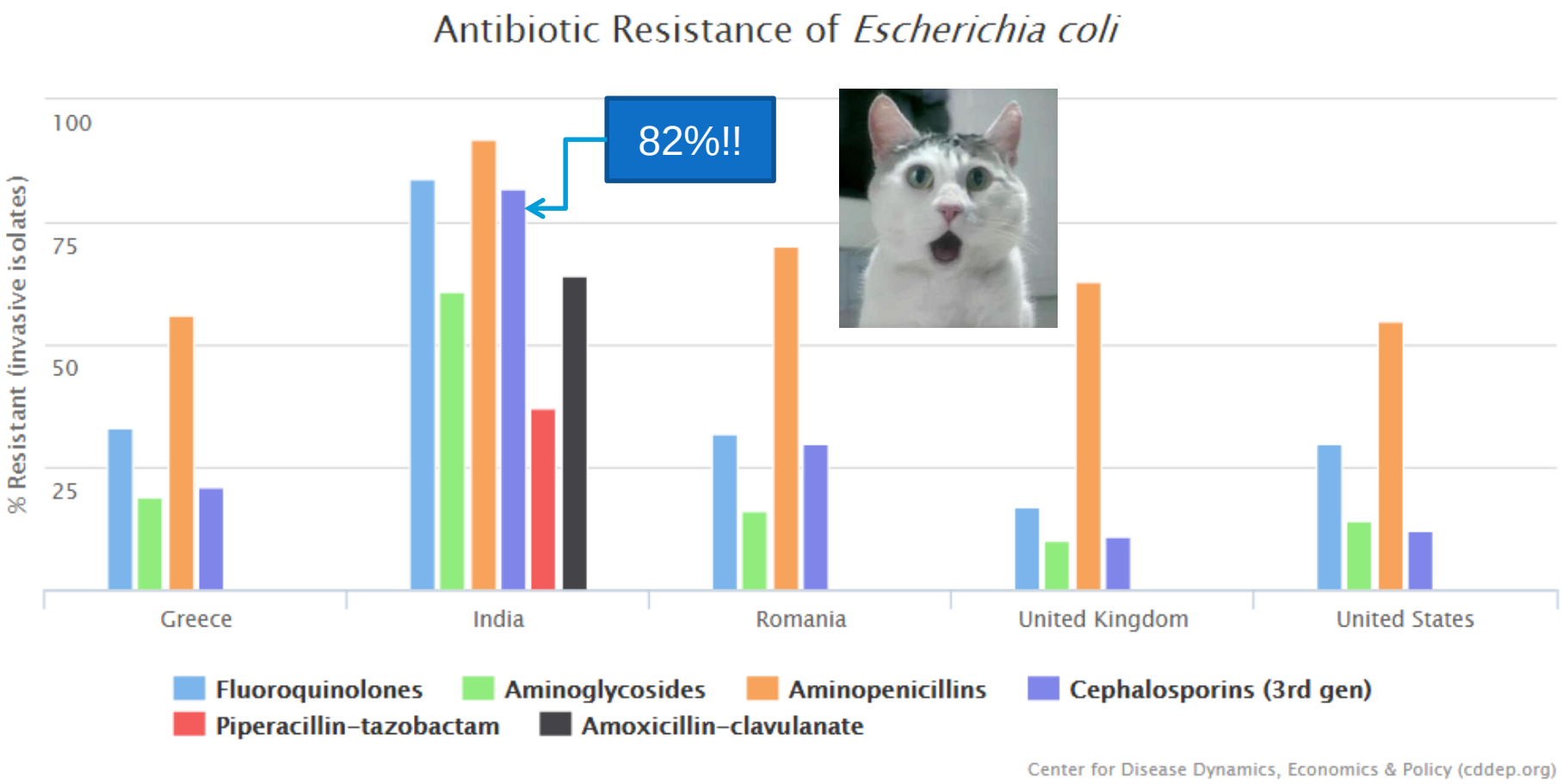
Image available from: https://resistancemap.cddep.org/AntibioticResistance.php

Antibiotic Resistance of *Escherichia coli* in United States



Center for Disease Dynamics, Economics & Policy (cddep.org)

Antimicrobial Resistance



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Antimicrobial Resistance

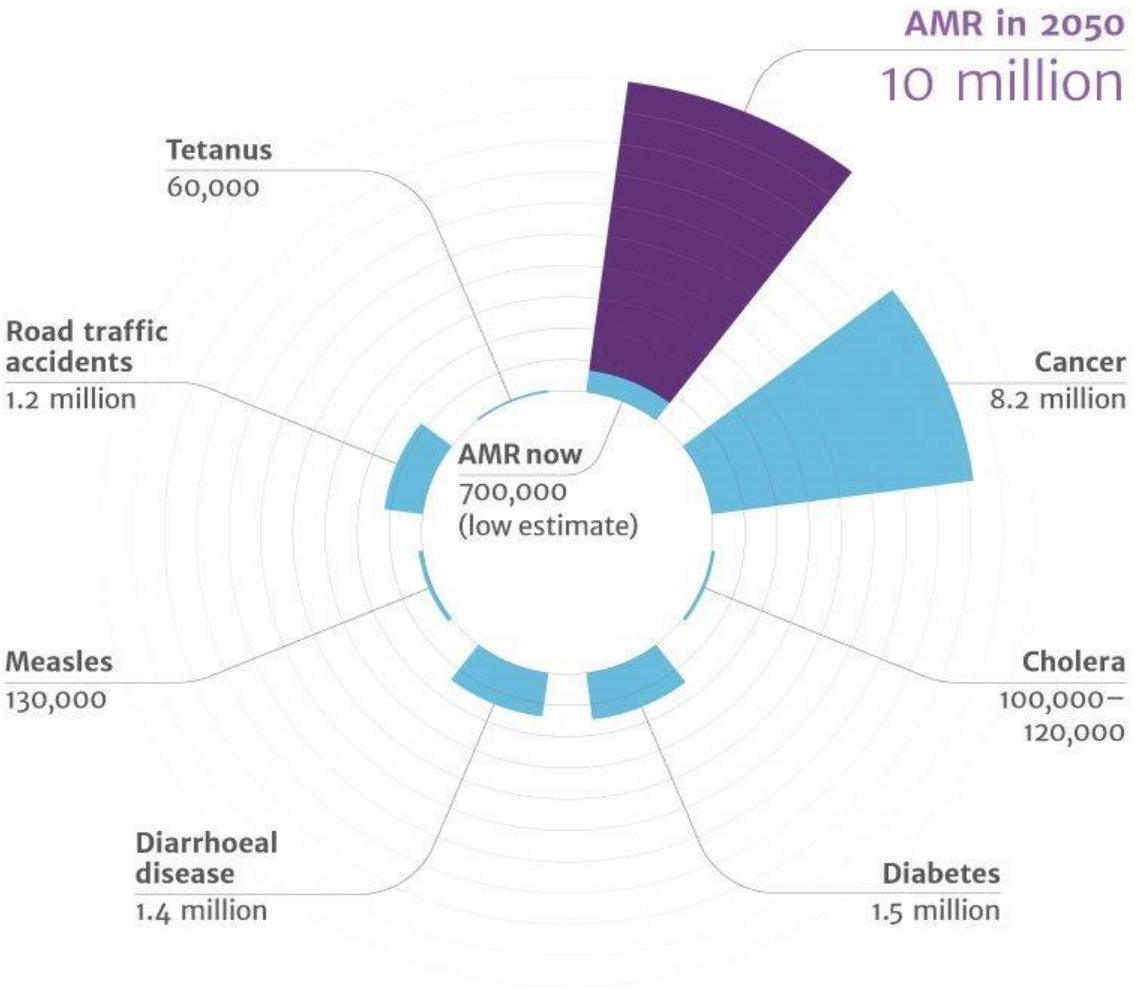
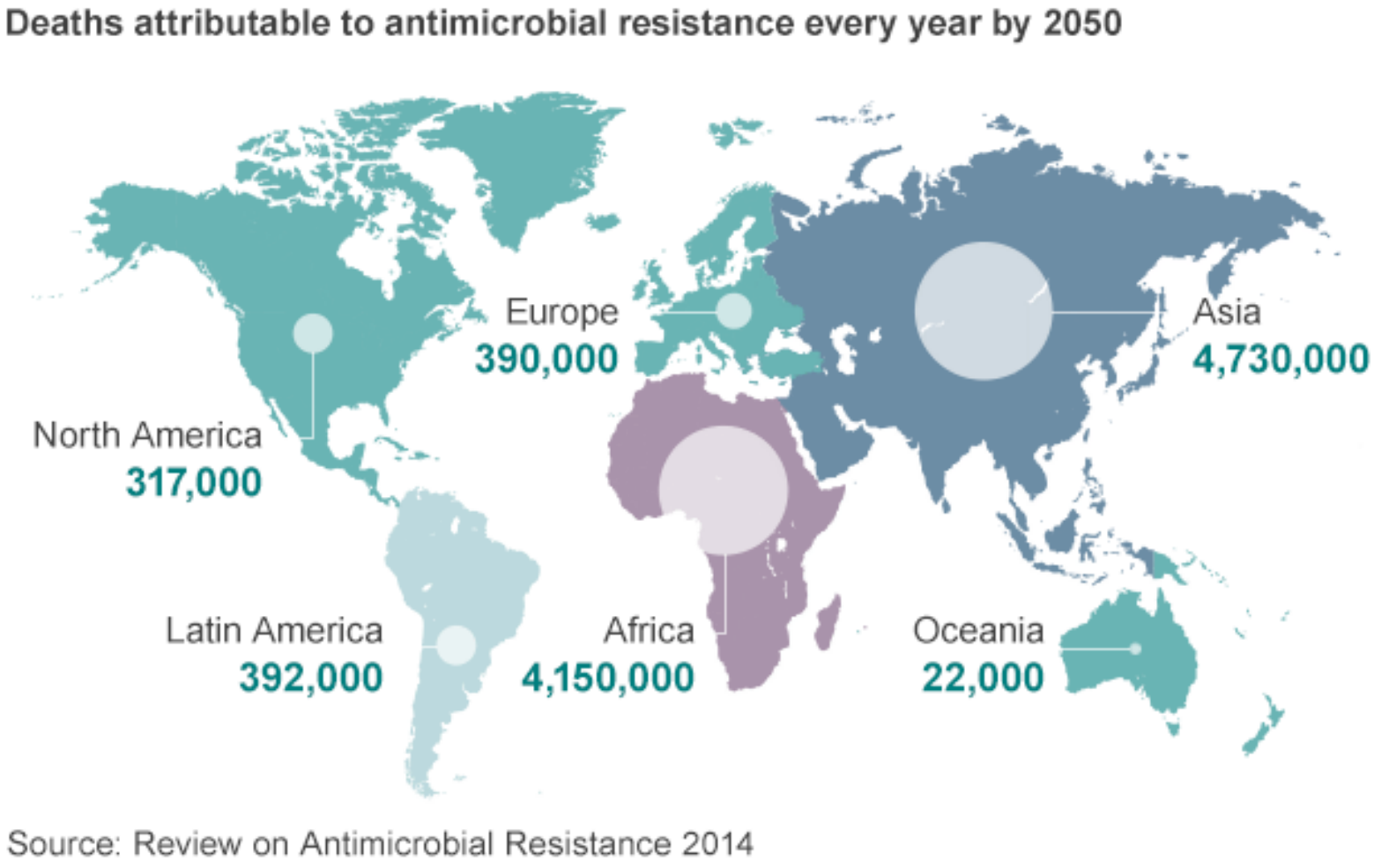


Image by O/Neill et al. Available from: http://amr-review.org/sites/default/files/AMR%20Review%20Paper%20-%20Tackling%20a%20crisis%20for%20the%20health%20and%20wealth%20of%20nations_1.pdf

Antimicrobial Resistance



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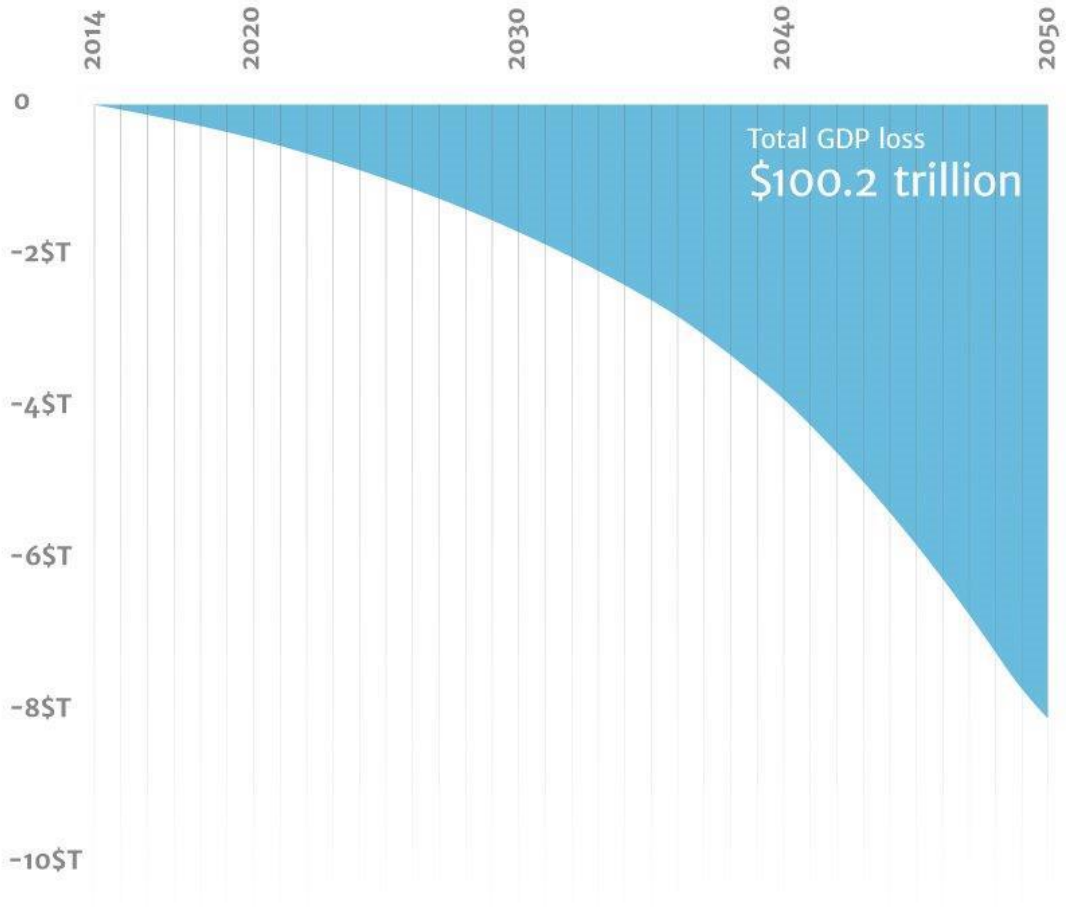
Antimicrobial Resistance



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Antimicrobial Resistance

Antibiotic Resistance Threats in the United States. CDC. 2013.

Table 1. Annual Cases and Deaths for Selected Antimicrobial-Resistant Organisms and *Clostridium difficile* Infection in the United States, 2008-2011[a]

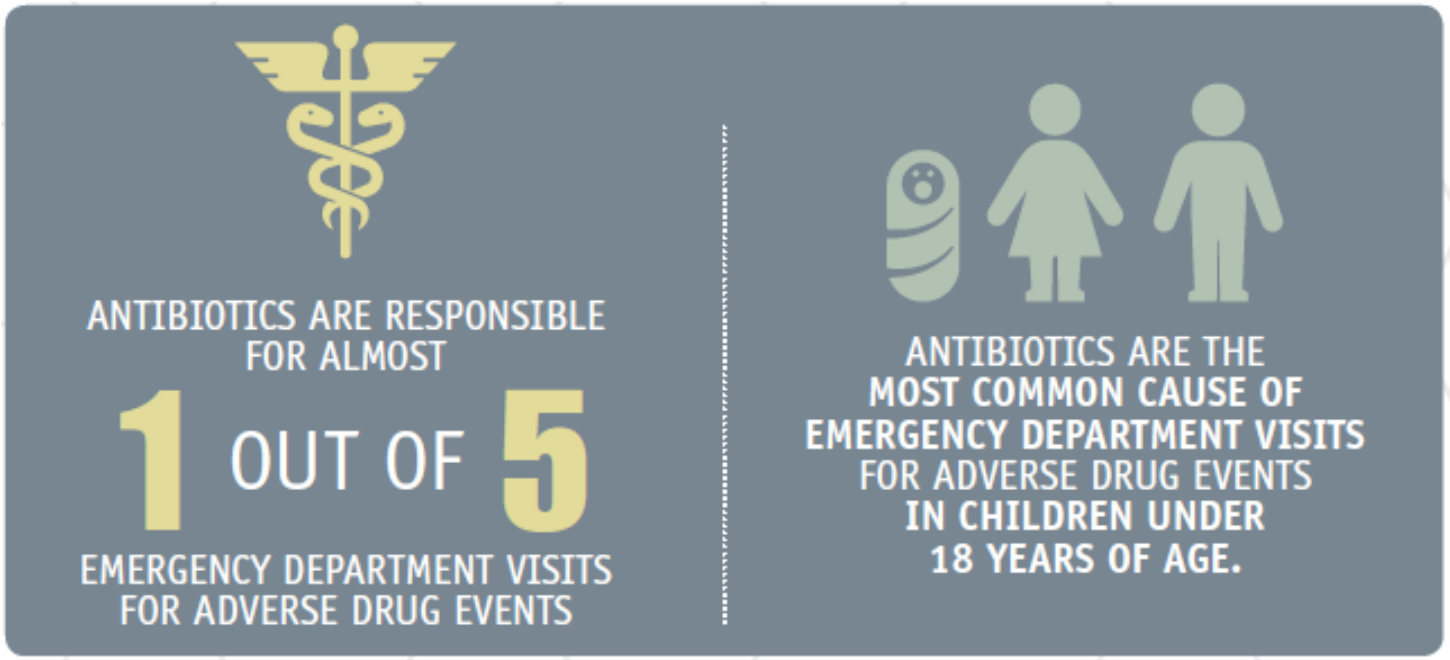
	Cases per Year	Deaths per Year
Streptococcus pneumoniae (resistant to clinically relevant drugs)	1.2 million	7000
Drug-resistant *Campylobacter*	310 000	28
Clostridium difficile	250 000	14 000
Drug-resistant *Neisseria gonorrhoeae*	246 000	< 5
Drug-resistant nontyphoidal *Salmonella*	100 000	38
Methicillin-resistant *Staphylococcus aureus*	80 461	11 285
Drug-resistant *Shigella*	27 000	40
Extended spectrum β-lactamase-producing Enterobacteriaceae	26 000	1700
Carbapenem-resistant Enterobacteriaceae	9300	610
Clindamycin-resistant group B *Streptococcus*	7600	440
Drug-resistant *Acinetobacter*	7300	500
Multidrug-resistant *Pseudomonas aeruginosa* (≥3 drug classes)	6700	440

[a] Organisms ordered by number of cases. Methods describing figure derivation are described in the technical appendix of the Centers for Disease Control and Prevention's *Antibiotic Resistance Threats in the United States, 2013*.[1]

~36,000 deaths per year

Marston H et al. JAMA 2016;316(11):1193-1204.

Antimicrobial Adverse Drug Reactions

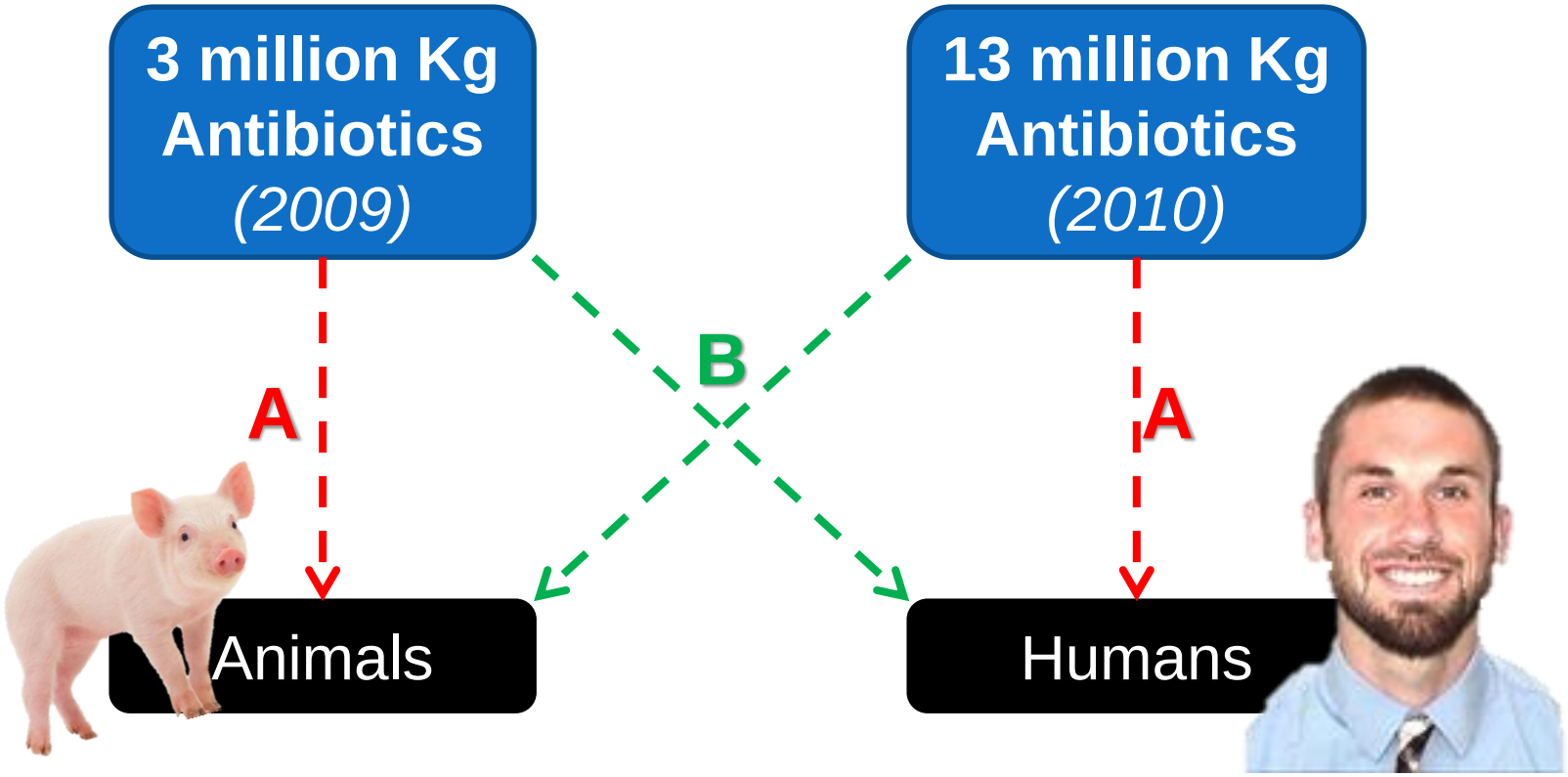


Antibiotic Resistance Threats in the United States. CDC. 2013.

What Drives Antimicrobial Resistance?

What is the number one factor that drives antimicrobial resistance?

Antibiotic Use in the U.S.



Spellberg B, et al. *N Engl J Med* 2013;368:299-302
Adapted with permission from Nicholas Torney, PharmD, BCPS

Antimicrobial Consumption in Livestock

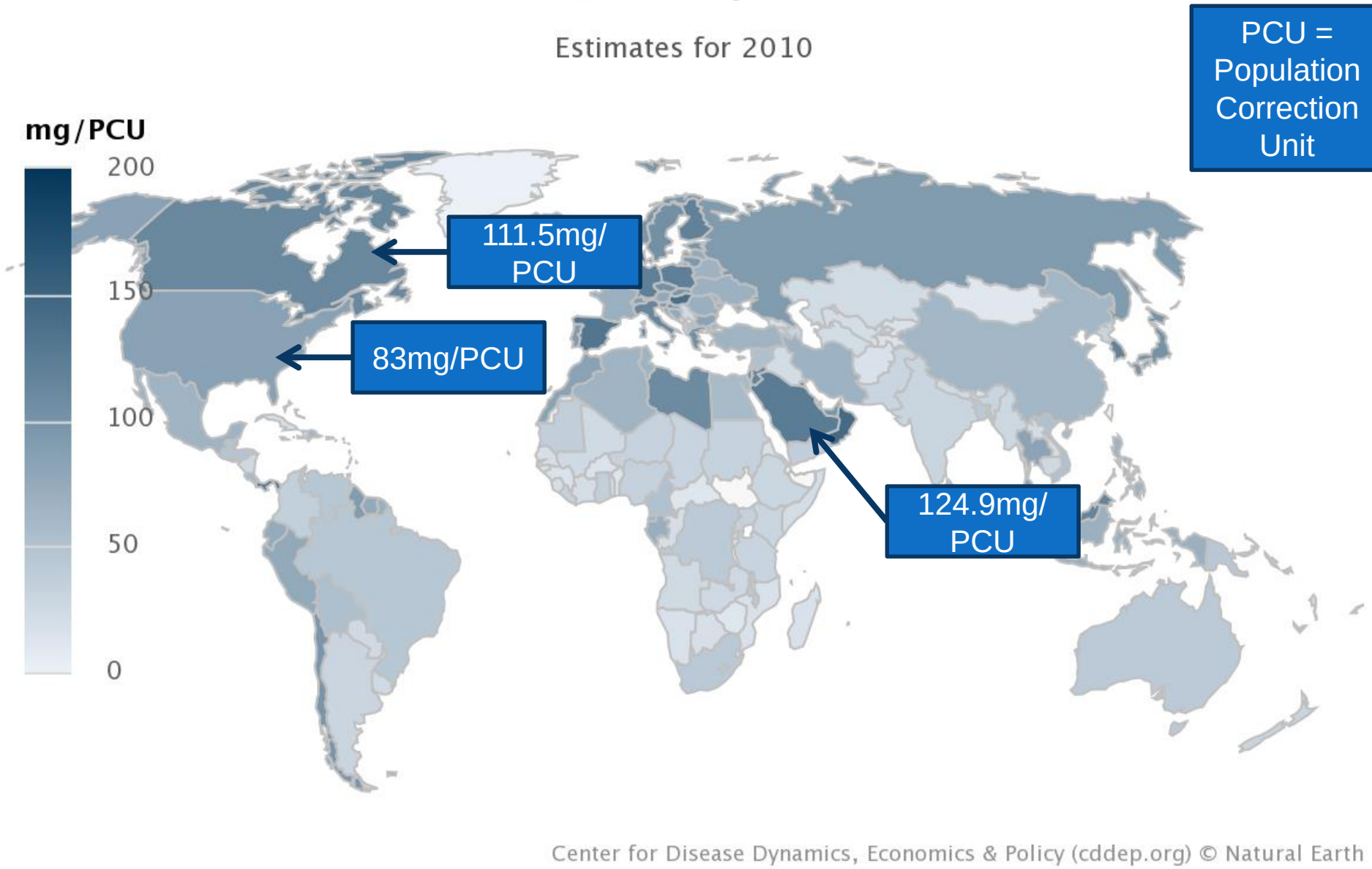
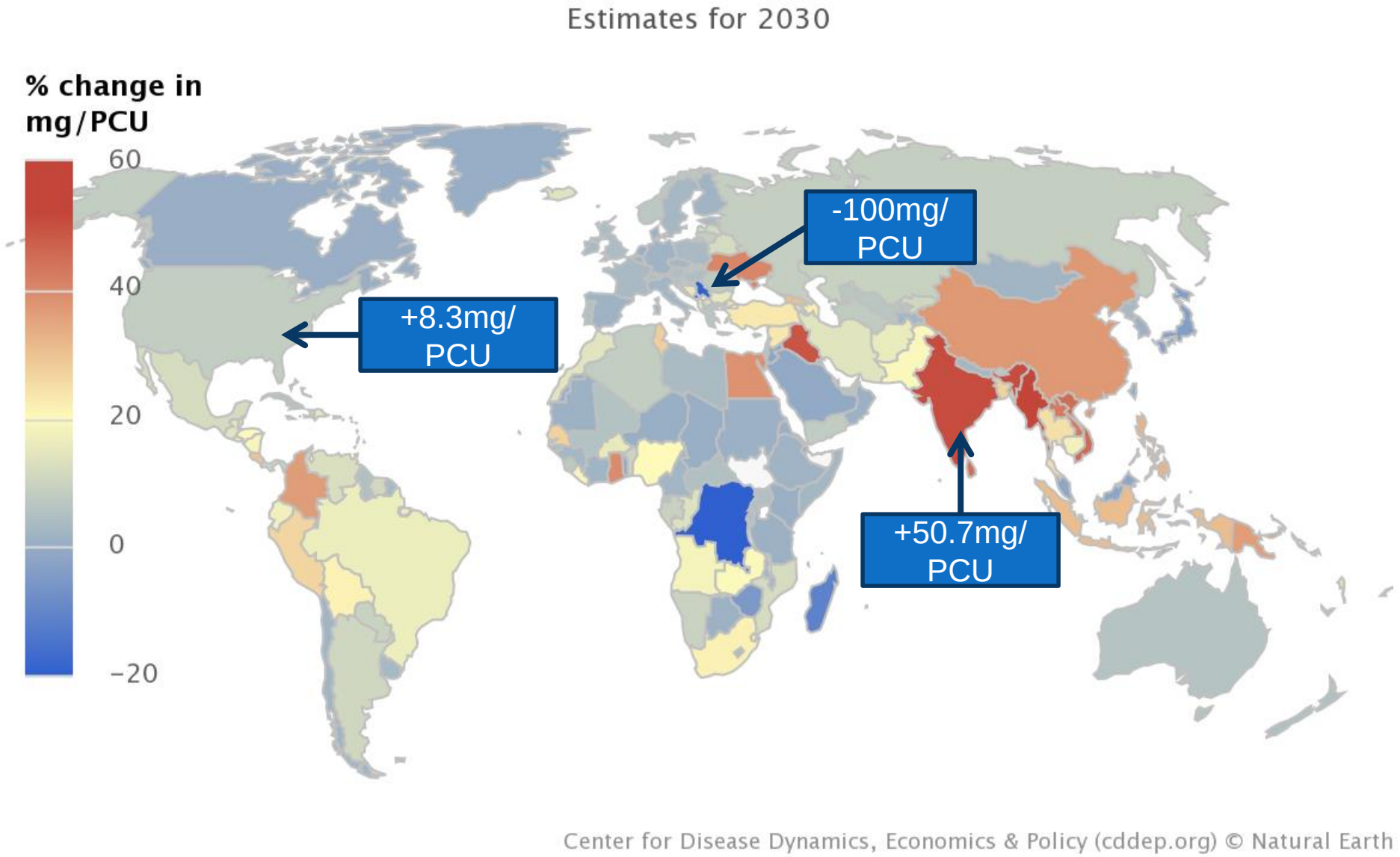


Image available from: https://resistancemap.cddep.org/AntibioticResistance.php

Change in Antimicrobial Consumption in Livestock



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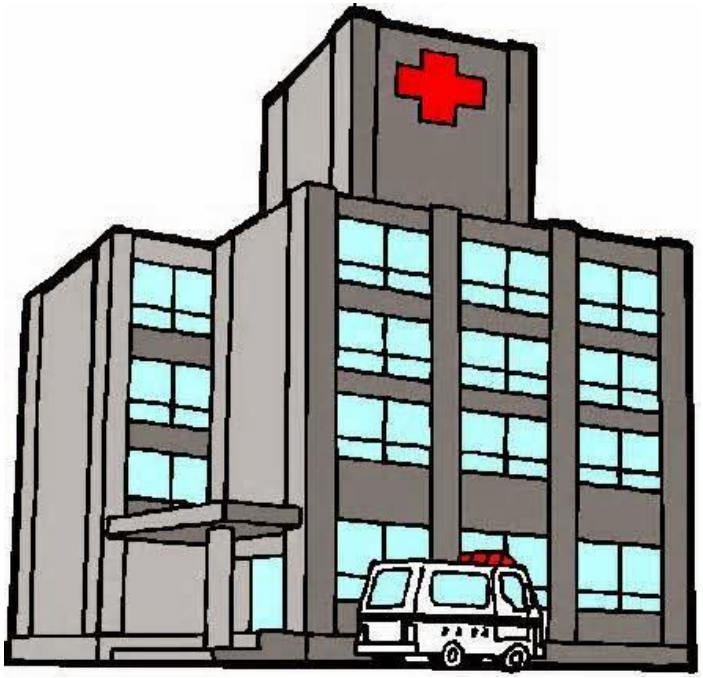
Human Antimicrobial Use

- Which setting uses more antimicrobials?

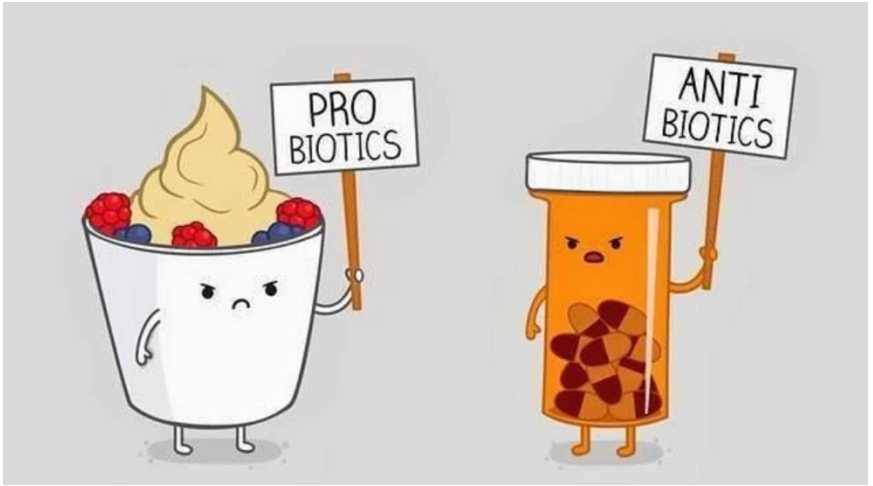


Inpatient

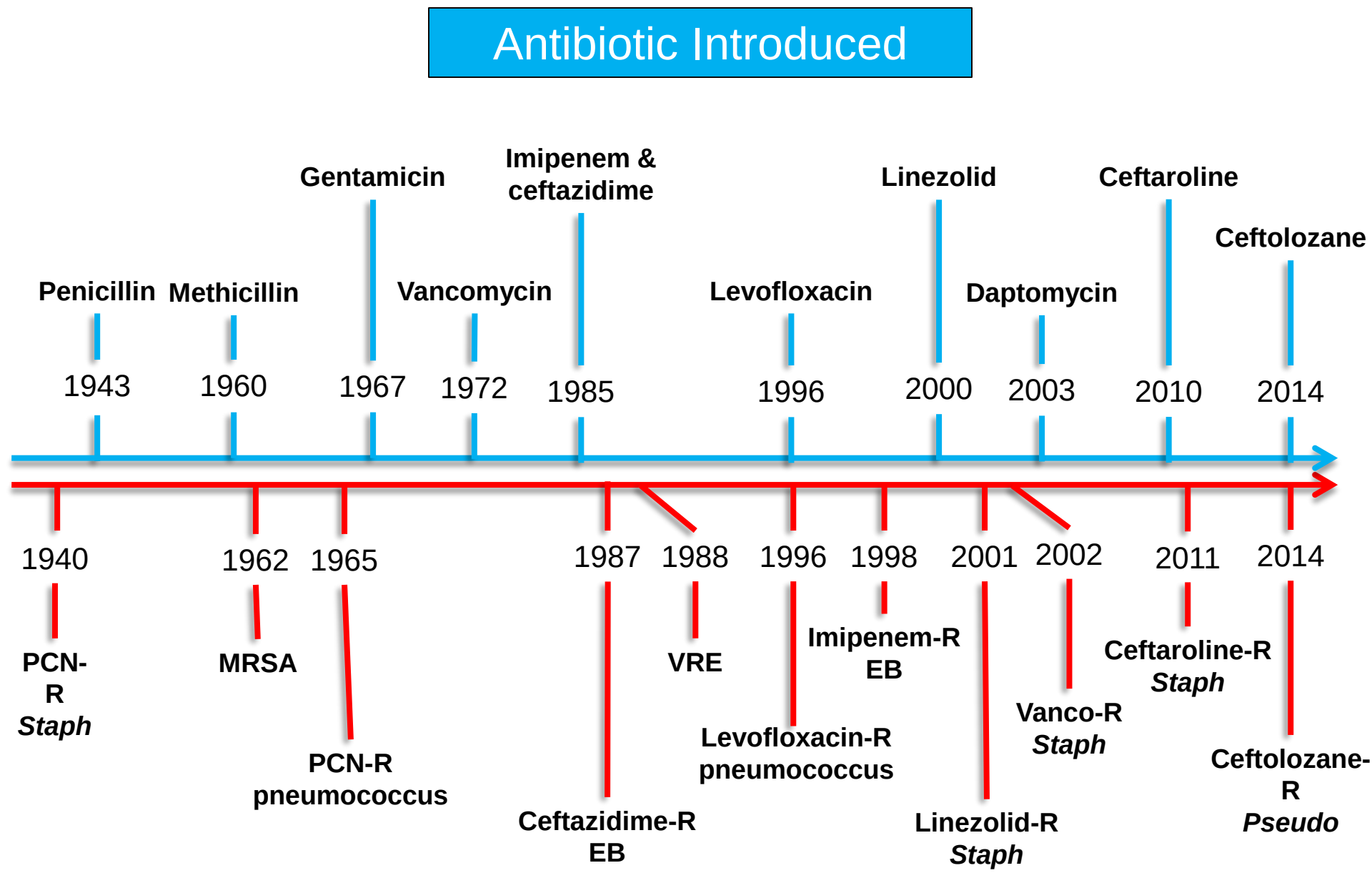
Outpatient

Antimicrobials in the Community

- An estimated 60% of all antimicrobials are prescribed in the outpatient setting
  - In 2013, healthcare providers issued about 269 million antibiotic prescriptions
    - Equates to approximately 849 antibiotic prescriptions/ 1000 persons
    - 5 antibiotic prescriptions annually for every 6 people in the United States



Suda KJ et al. J Antimicrob Chemother. 2013 Mar;68(3):715-8.
Get Smart: Know When Antibiotics Work. CDC. 2016.

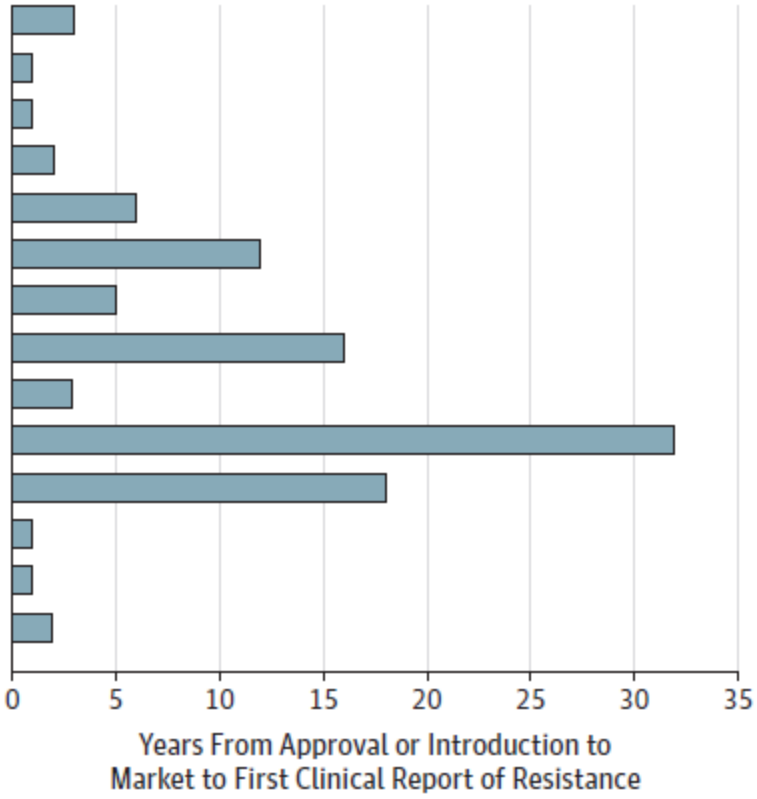


Adapted from:
Antibiotic Resistance Threats in the United States, 2013, CDC

EB = Enterobacteriaceae

Figure 1. Time From Antibiotic Approval or Introduction to Detection of Resistance in Clinical Samples

Class	Antibiotic	Year of Approval or Introduction to Market
β-Lactams	Penicillin	1942
	Methicillin	1960
	Cephalothin	1964
	Amoxicillin-clavulanic acid	1984
Carbapenems	Imipenem-cilastatin	1985
Amphenicols	Chloramphenicol	1950
Tetracyclines	Tetracycline	1953
Aminoglycosides	Streptomycin	1946
Macrolides	Erythromycin	1952
Glycopeptides	Vancomycin	1958
Quinolones	Nalidixic acid	1964
Streptogramins	Quinupristin-dalfopristin	1999
Oxazolidinones	Linezolid	2000
Lipopeptides	Daptomycin	2003



Marston H et al. JAMA 2016;316(11):1193-1204.

Troublesome Pathogens

Urgent Threats

- *Clostridium difficile*
- CRE
- Drug-resistant *Neisseria gonorrhoeae*

Serious Threats

- MDR *Pseudomonas*
- VRE
- ESBL producing Enterobacteriaceae
- MRSA
- PCN-Resistant *Streptococcus pneumoniae*
- More!

Concerning Threats

- VRSA
- Erythromycin-resistant Group A *Streptococcus*
- Clindamycin-resistant Group B *Streptococcus*

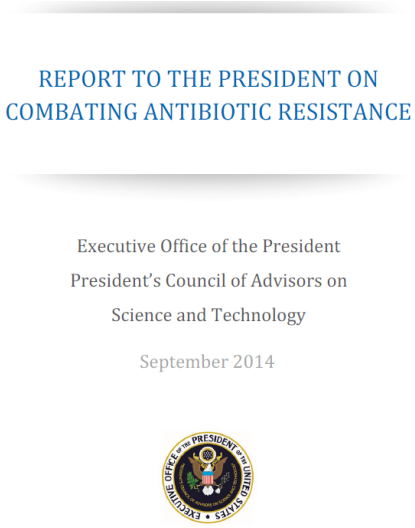
Adapted from:
Antibiotic Resistance Threats in the United States, 2013, CDC

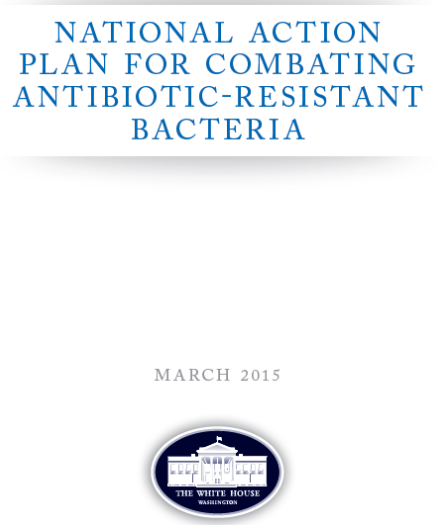
Checkmate, Resistance

Image available from: http://loonylabs.org/2015/02/01/phages-antibiotics-genetics/

National Mandates

- Centers for Medicare & Medicaid Services (CMS) and the Joint Commission (JC) will require ASPs for all acute health facilities starting in ***2017***





Images available from:
https://www.whitehouse.gov/sites/default/files/microsites/ostp/PCAST/pcast_carb_report_sept2014.pdf
https://www.whitehouse.gov/sites/default/files/docs/national_action_plan_for_combating_antibotic-resistant_bacteria.pdf

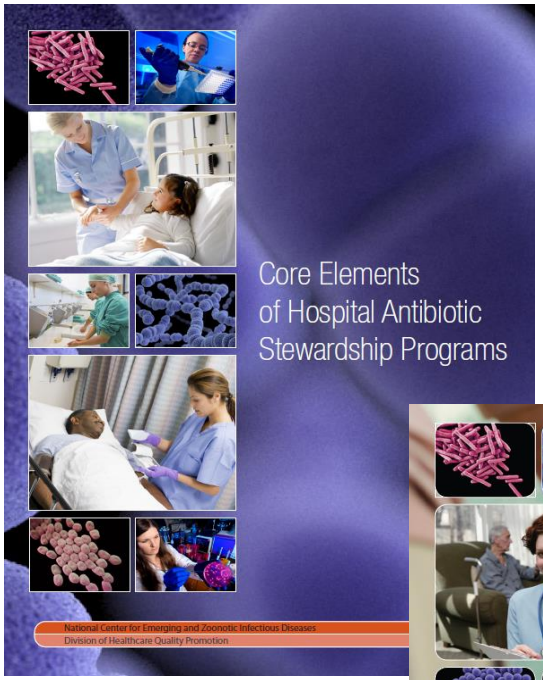
National Mandates

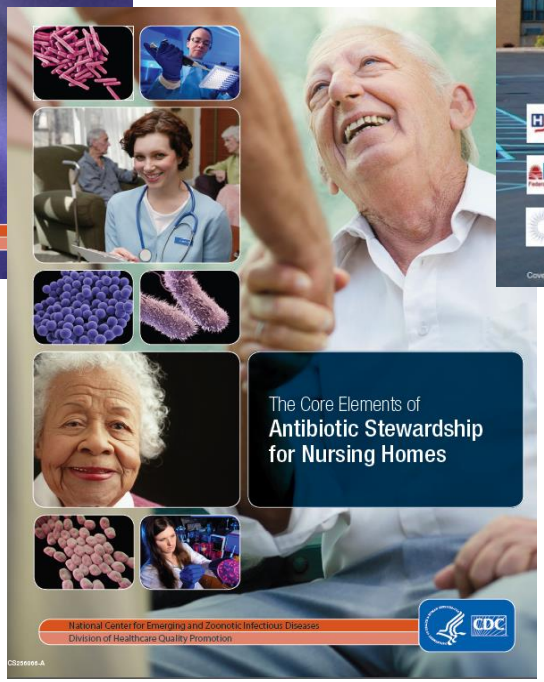
NATIONAL ACTION PLAN FOR COMBATING ANTIBIOTIC-RESISTANT BACTERIA

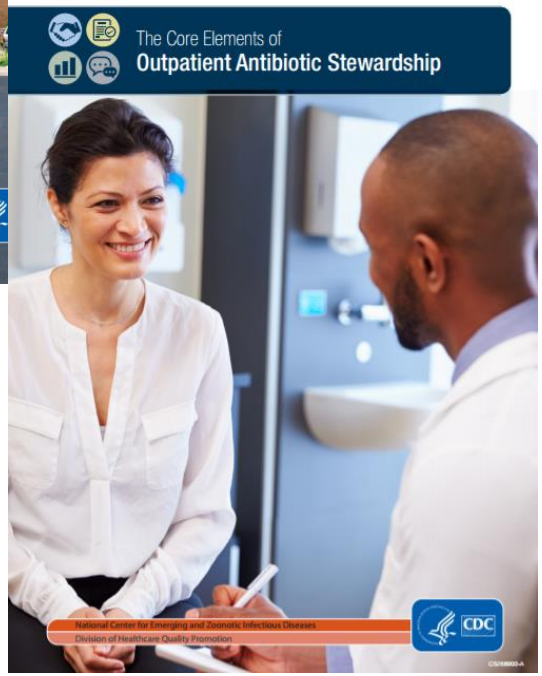
Within three years:

- All hospitals that participate in Medicare and Medicaid programs must comply with Conditions of Participation (COP). The Centers for Medicare & Medicaid Services (CMS) will issue new COPs or revise current COP *Interpretive Guidelines* to advance compliance with recommendations in CDC's *Core Elements of Hospital Antibiotic Stewardship Programs.* HHS, DOD, and VA will also implement policies that:
  - Encourage implementation of antibiotic stewardship programs as a condition for receiving Federal grants for health care delivery (e.g., in community healthcare centers).
  - Require health facilities operated by the U.S. Government to develop and implement antibiotic stewardship programs and participate in NHSN reporting (see Objective 2.2).
- All acute care hospitals governed by the CMS COP will implement antibiotic stewardship programs. CMS will expand COP requirements to apply to long-term acute care hospitals, other post-acute facilities, ambulatory surgery centers, and dialysis centers.

Centers for Disease Control and Prevention (CDC) Core Elements of Antimicrobial Stewardship







Images available: cdc.gov

CDC Core Elements

- Key Elements of Hospital Antimicrobial Stewardship Program:
  1. Leadership support
  2. Accountability
  3. Drug Expertise
  4. Optimal Antimicrobial Use
  5. Tracking
  6. Reporting
  7. Education

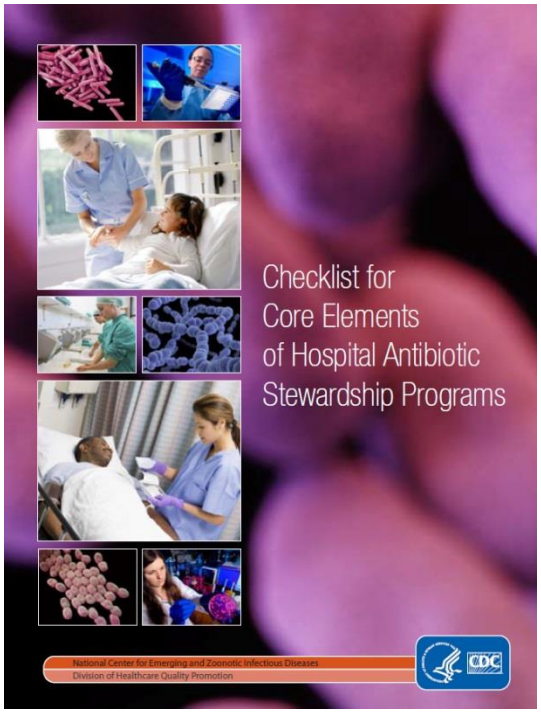
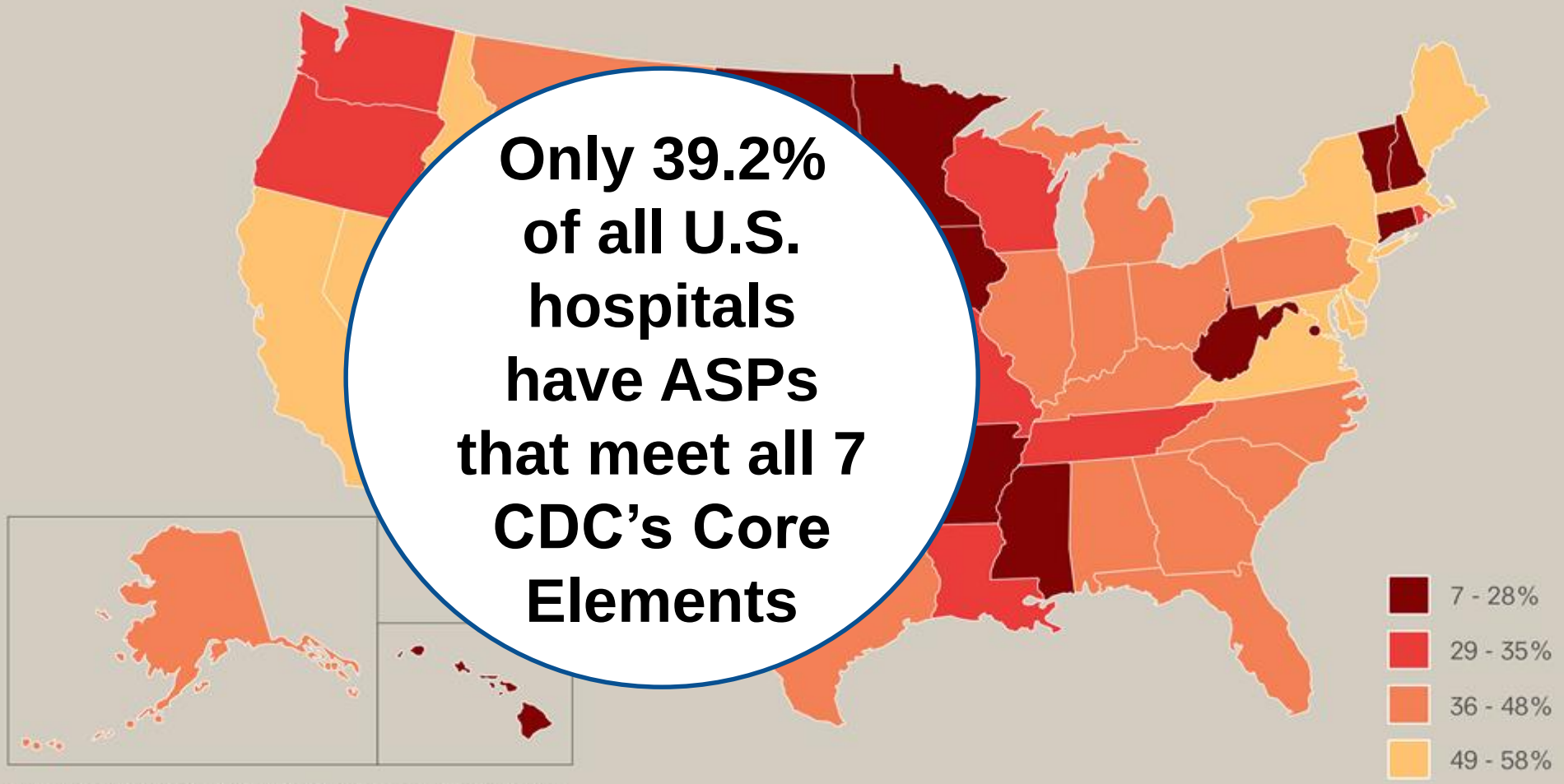


Image available from:
http://www.cdc.gov/getsmart/healthcare/pdfs/checklist.pdf

Percent of Hospitals with Antibiotic Stewardship Programs by State, 2014*

Antibiotic stewardship programs ensure patients get the right antibiotics at the right time for the right duration



*A hospital stewardship program is defined as a program following all 7 of CDC core elements of antibiotic stewardship programs.

AE, AP, AS, GU, VI data are not shown due to 7 or fewer hospital respondents but are included in the overall percentage.

Source: CDC's NHSN Survey

GET SMART About Antibiotics Week
WWW.CDC.GOV/GETSMART

Nationally, 39.2% of all hospitals have stewardship programs (1642 of 4184); the national goal is 100% of hospitals by 2020.

Adapted with permission from Michael Tiberg, PharmD, BCPS

Leadership Commitment

- Demonstrate commitment and support of safe and appropriate antimicrobial use within your facility
- The facility should have:
  - Written statements supporting ASP work
  - Incorporate ASP-related duties in employee responsibilities
  - Communicate the importance of ASP duties
  - Promote a culture to improve ASP buy-in

Core Elements of Antibiotic Stewardship for Nursing Homes. CDC. 2015.
Image available from: https://www.cdc.gov/longtermcare/pdfs/core-elements-antibiotic-stewardship.pdf

Accountability

- Identify leaders responsible for overseeing ASP activities within the facility
  - An ASP leader can be anyone!
    - Physician
    - Pharmacist
    - Nurse
  - ASP leaders should form the AST including
    - All providers
    - Nursing representation
    - Pharmacists
    - Infection prevention staff
    - Laboratory staff

Core Elements of Antibiotic Stewardship for Nursing Homes. CDC. 2015.
Image available from: https://www.cdc.gov/longtermcare/pdfs/core-elements-antibiotic-stewardship.pdf

Drug Expertise

- Establish relationships with pharmacists with experience or training in ASPs
- The facility should seek out experts whenever possible
  - Develop relationships with hospital ASP experts
    - Infectious diseases pharmacists & physicians
  - Utilize any pharmacist available
    - Pharmacokinetic & pharmacodynamics dose optimization
    - Dosing in renal dysfunction

Core Elements of Antibiotic Stewardship for Nursing Homes. CDC. 2015.
Image available from: https://www.cdc.gov/longtermcare/pdfs/core-elements-antibiotic-stewardship.pdf

Action

- Implement a minimum of one policy or practice to improve antibiotic use
  - The facility should start slow!
    - Try to only implement one policy or practice change at a time
  - Identify “problem areas” and hit those first!
  - Potential Interventions:
    - Clinical guideline development
    - Antibiogram use
    - Restricted antimicrobials
    - Antimicrobial de-escalation
    - Disease state specific monitoring

Core Elements of Antibiotic Stewardship for Nursing Homes. CDC. 2015.
Image available from: https://www.cdc.gov/longtermcare/pdfs/core-elements-antibiotic-stewardship.pdf

Tracking

- Implement a process for measuring at least one antibiotic use process and antibiotic related outcome
- Measuring the success of any ASP is a serious challenge
  - At first, aim for the easy metrics
- Possible metrics:
  - Antimicrobial use data
    - Why were antimicrobials prescribed? Were they appropriate?
  - Antimicrobial associated adverse events
    - *C. difficile* rates, local resistance rates
  - Total antimicrobial use
    - Days of therapy (DOT), defined daily doses (DDD)
  - Antimicrobial cost

Core Elements of Antibiotic Stewardship for Nursing Homes. CDC. 2015.
Image available from: https://www.cdc.gov/longtermcare/pdfs/core-elements-antibiotic-stewardship.pdf

Reporting

- Providing feedback to all staff on facility ASP activities
  - Obtaining quality data can be a serious challenge to ASPs
- Potential Metrics:
  - Personalized provider feedback
  - Site specific *C. difficile* rates
  - Site specific antibiogram data
  - Antimicrobial use data
    - DOT, DDD when possible

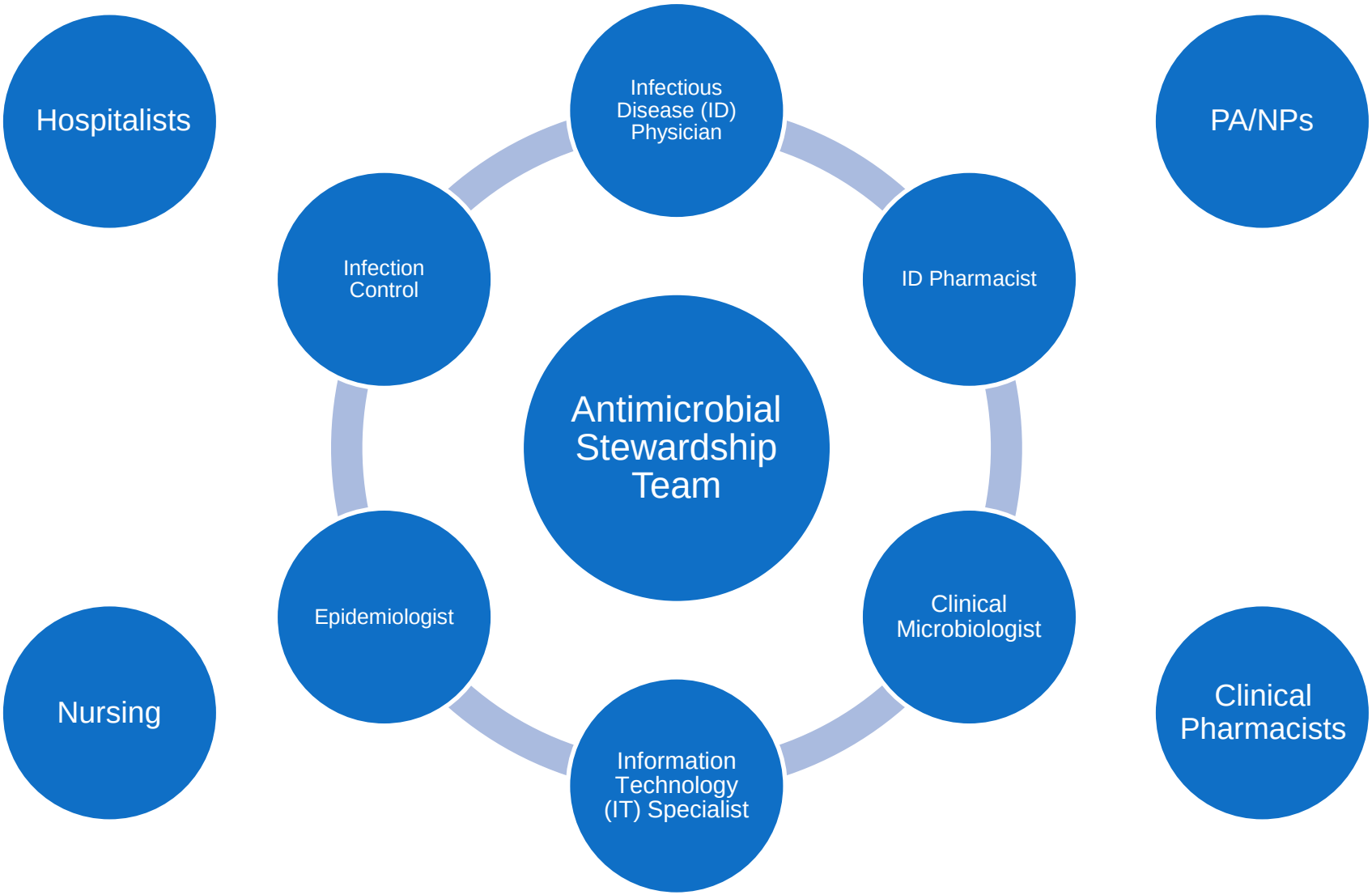
Core Elements of Antibiotic Stewardship for Nursing Homes. CDC. 2015.
Image available from: https://www.cdc.gov/longtermcare/pdfs/core-elements-antibiotic-stewardship.pdf

Education

- Provide resources to employees and patients on antimicrobial resistance and the efforts made to improve antimicrobial use
  - **Everyone** should be educated on the importance of the ASP
- Possible forms of education:
  - Infectious diseases guideline review to prescribers
  - Ensure rapid diagnostics are done when applicable
    - Rapid *Streptococcus* test is documented positive before prescribing antibiotics
  - Basics of antimicrobial resistance and when to use antibiotics to residents and their families

Core Elements of Antibiotic Stewardship for Nursing Homes. CDC. 2015.
Image available from: https://www.cdc.gov/longtermcare/pdfs/core-elements-antibiotic-stewardship.pdf

Antimicrobial Stewardship Team



ASP Interventions

- Common Interventions:
  - Prospective audit & feedback
  - Restricted antimicrobials
  - IV to PO automatic conversion policy
  - Institution-specific antibiogram development
  - Pharmacokinetic/pharmacodynamic optimizations
  - Facility-specific clinical practice guidelines
  - Indication-specific clinical practice guidelines
  - Healthcare provider education

Spectrum Health: Antimicrobial Stewardship

Image available from: https://www.spectrumhealth.org/patient-care/childrens-health/neonatal-care/about-the-nicu

Spectrum Health

Service Area

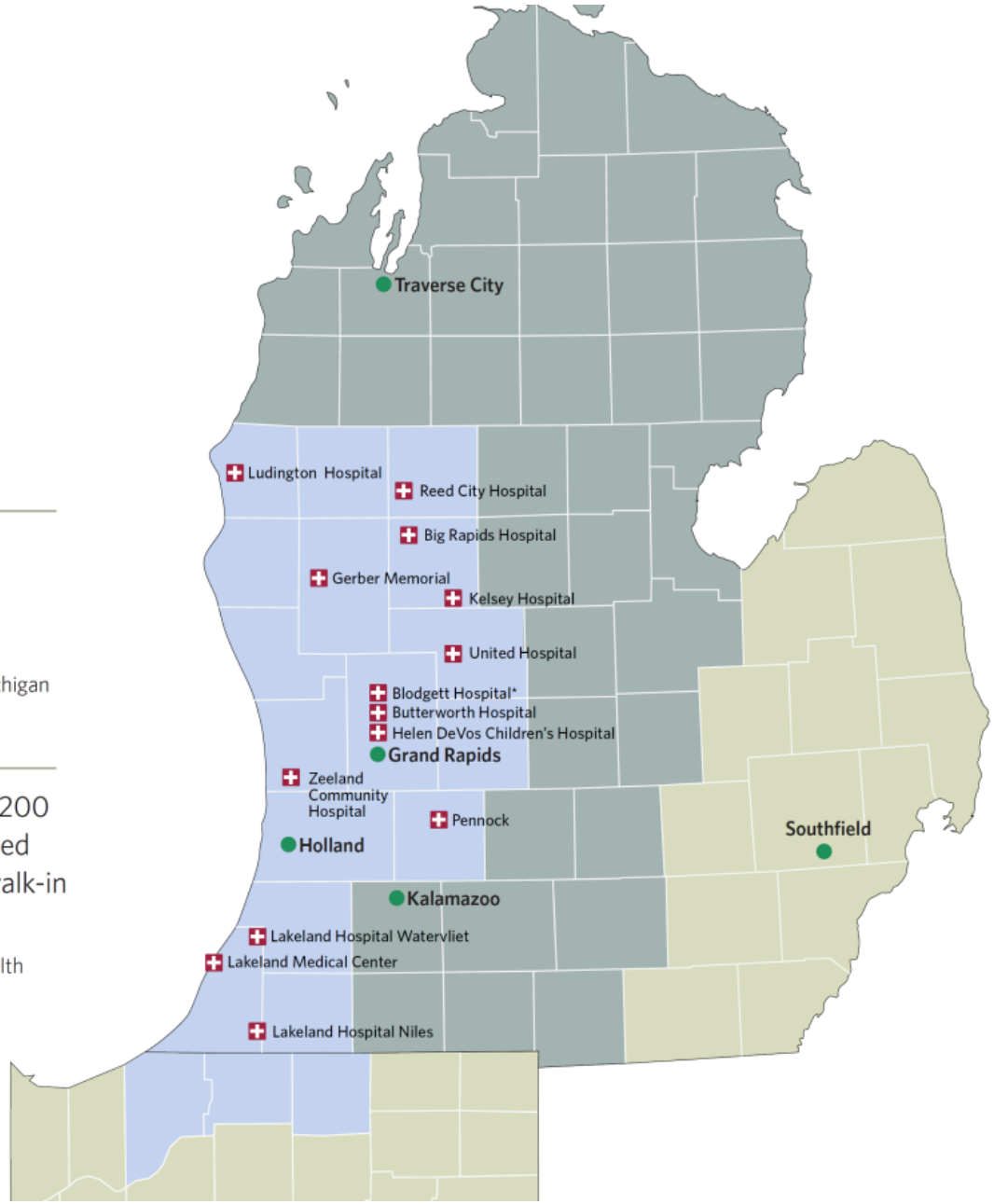
Additional HDVCH Service Area

Priority Health Locations

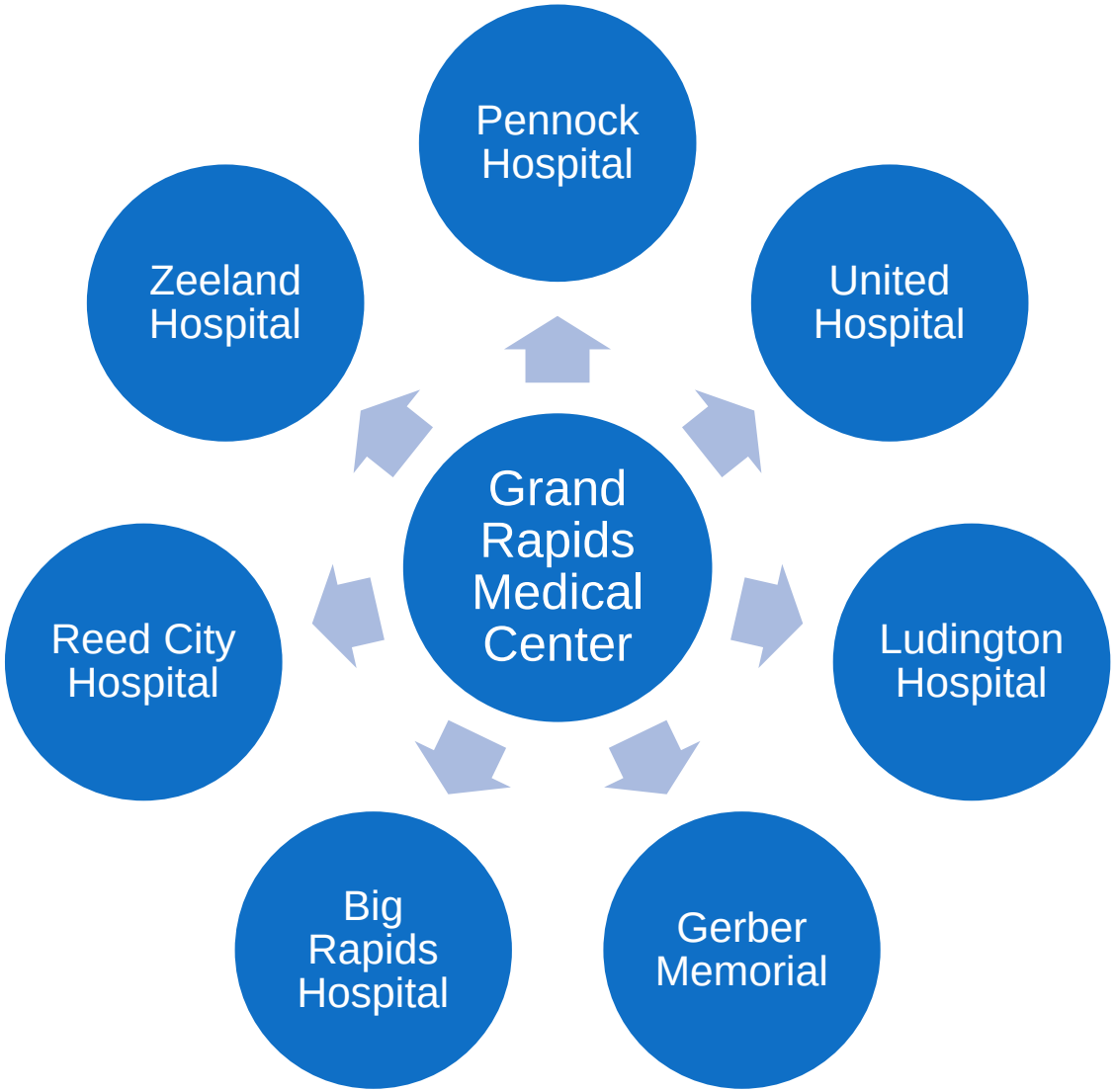
Priority Health service area extends across Michigan

Spectrum Health also has more than 200 outpatient facilities (including integrated care campuses, urgent care centers, walk-in clinics and physician offices).

*Includes Select Specialty Hospital – Spectrum Health (A joint venture with Select Medical Corporation).



Tele-Stewardship



Spectrum Health: Antimicrobial Stewardship Team

- Infectious Diseases (ID) Physicians:
  - Four adult ID physicians & three pediatric ID physicians
    - One ID physician lead for each SHGR, community hospitals, and children's hospital
  - Three ID pharmacists:
    - Two adult ID pharmacists
    - One pediatric ID pharmacist
    - Seven PGY1 pharmacy residents

Image available from: http://www.fighttheresistance.org/

Spectrum Health: Antimicrobial Stewardship

- Formulary restriction and preauthorization
  - Predefined list of antimicrobials with use beyond 24 hours is restricted to infectious diseases providers

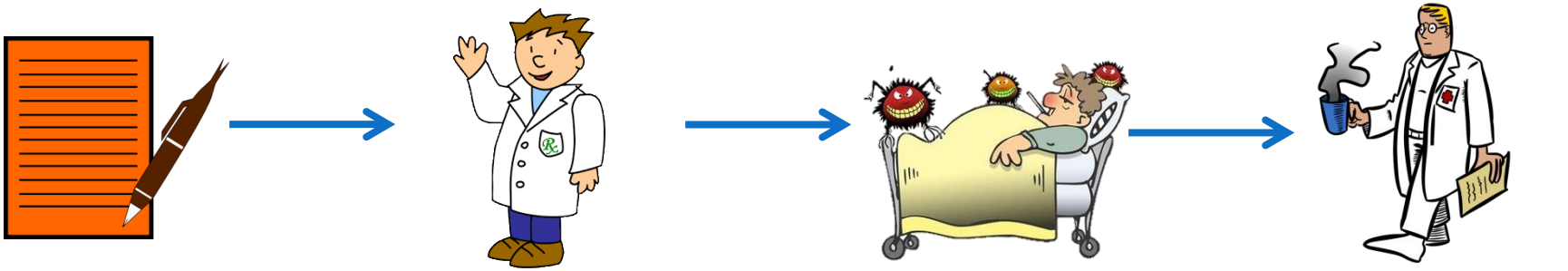
Barlam T et al. Clin Infect Dis. 2016 ;62(10):e51-e77.

Spectrum Health: Antimicrobial Stewardship

- Amikacin
- Amphotericin B
- Amphotericin B liposome
- Anidulafungin
- Aztreonam
- Ceftaroline
- Ceftolozane/tazobactam
- Ceftazidime/avibactam
- Colistin
- Daptomycin
- Ertapenem
- Fidaxomycin
- Imipenem/cilistatin
- Linezolid
- Meropenem
- Meropenem/Vaborbactam
- Micafungin
- Posaconazole
- Quinupristin/dalfopristin
- Tigecycline
- Voriconazole

Spectrum Health: Antimicrobial Stewardship

- **Prospective audit and feedback**



List generation | ID PharmD chart review | ID pharmacy team rounds | Multidisciplinary stewardship rounds

- Recommendations communicated to provider via progress notes in the electronic medical record or verbal communication

Barlam T et al. Clin Infect Dis. 2016 ;62(10):e51-e77.

Spectrum Health: Antimicrobial Stewardship

- Additional Interventions:
  - Specific diseases state review
  - Criteria for ordering diagnostic tests
  - Rapid Diagnostic Tests:
    - MALDI-TOF®
    - BioFire FilmArray®
      - Respiratory Panel
      - Blood Culture Panel
      - Meningitis Panel
  - HMS consortium – Antimicrobial Use Pilot
  - Penicillin Allergy Assessment

Clostridioides difficle

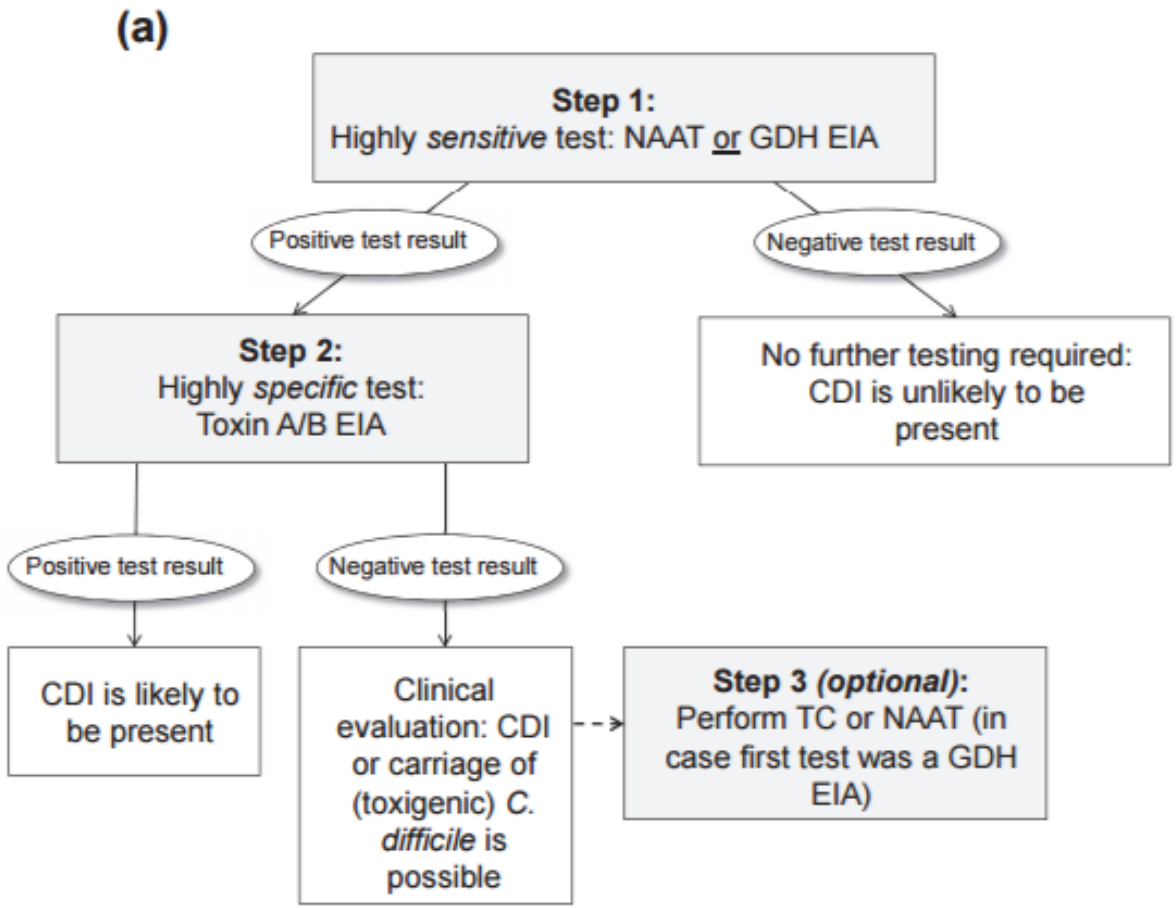
- Medicare has reduced hospital reimbursement for certain hospital-acquired conditions
- C. difficile infection (CDI), CAUTI and CLABSI
  - ≥ 40% of patients with (+) C. difficile test (by PCR) are colonized (without CDI)
- Updated IDSA guidelines recommend multi-step algorithm for testing

Clostridioides difficle

- ASP recommendations:
- Criteria for C difficile testing
  - No laxative use
  - ≥ 3 liquid stools in the previous 24 hrs (stool sample must conform to the shape of the container)
- Replace PCR with 2 stage testing (EIA ± GDH)

Clostridioides difficle

M.J.T. Crobach et al. / Clinical Microbiology and Infection 22 (2016) S63–S81



Clostridioides difficle

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- Criteria for C difficile testing
  - No laxative use
  - ≥ 3 liquid stools in the previous 24 hrs (stool sample must conform to the shape of the container)
- Replace PCR with 2 stage testing (EIA ± GDH)

Quarter	HO Cdiff	pt days	Rate
2016Q1	40	65736	0.061
2016Q2	45	63362	0.071
2016Q3	28	64439	0.043

- Rate = positive test/10,000 patient days
- A 40% reduction!!!

Clostridioides difficile

How could you improve healthcare-associated CDI rates in your workplace?

Asymptomatic Bacteriuria

Image available from: https://www.ammi.ca/?ID=127

Image available from: https://www.ammi.ca/?ID=127

The Culture of Culturing

Prior to ASP

- Urine cultured if two or more of the following:
  - Positive LE
  - Positive for Nitrites
  - WBC ≥ 3

After ASP

- Urine cultured if two or more of the following:
  - Positive LE
  - Positive for Nitrites
  - WBC ≥ 10
  - Sample rejected if ≥ 10 squamous epithelial cells present

Resulted in a 30% reduction in urine cultures processed!

Asymptomatic Bacteriuria

How could you decrease the rates of treatment of ASB in your workplace?

Penicillin Allergies

- The most commonly reported antibiotic allergy ranging from 8-25% of ambulatory and hospitalized patients
- Patient's with a penicillin allergy are three times the odds of experiencing an adverse drug reaction
- Hospitalized patients have a higher incidence of multi-drug resistant organisms (MDROs)
  - 30% increased incidence of vancomycin-resistant *Enterococcus* (VRE)
  - 14% increased incidence of methicillin-resistant *Staphylococcus aureus* (MRSA)

Owens R et al. Pharmacotherapy. 2004;24(7):896-908.
Blumenthal et al. J Allergy Clin Immunol Pract. 2017;5.3:616-25.

Penicillin Allergies

- Approximately 90-95% of patients with a listed penicillin allergy do not have a type I hypersensitivity reaction
  - Penicillin allergies are commonly mislabeled:
    - Penicillins cause rashes!
    - Excipients in previously used products:
      - IM penicillin reactions
    - Interactions with disease states:
      - Epstein Barr Virus
      - *Treponema pallidum*
- None of these are life threatening reactions!

Sacco KA et al. Emerg Infect Dis. 2007;13:994-1000.
Blanca M et al. J Allergy Clin Immunol. 1999;103:918-24.
Blumenthal K et al. BMJ. 2018;361.

Figure 1.0 Penicillin Allergy Inpatient Algorithm

- A carbapenem (imipenem, ertapenem, meropenem) is the treatment of choice, but patient has a listed penicillin allergy.

Yes → **Give the carbapenem of choice.** Refer to Allergy clinic for outpatient penicillin allergy evaluation/testing.

Penicillin treatment indicated in a hospitalized patient with a listed Penicillin allergy:

- Patient has never taken or never reacted to a penicillin antibiotic. Family member history of penicillin allergy is the reason for the listed penicillin allergy for the patient.
- Penicillin reaction symptoms not consistent with an IgE-mediated reaction (i.e. headache, diaper rash, or itchiness without rash)
- Penicillin reaction was isolated mild GI symptoms (vomiting, nausea, diarrhea)
- Penicillin reaction was a delayed-onset (day 3 of course or later) mild rash without other symptoms

Yes → **Give the penicillin of choice.** No test dose needed. Update allergies in EMR.

No ↓

- Penicillin reaction was "hives" or itchy, raised, red rash without other symptoms.
- The patient (or guardian) denies a history of reaction to a penicillin antibiotic, despite it being listed in his/her allergies. Using the search function in the chart is consistent with the patient/guardian's

Yes → **Give a penicillin antibiotic by test dose procedure.** Update allergies in EMR.

No ↓

- Penicillin reaction history is consistent with a Type II, III, or IV hypersensitivity reaction or severe cutaneous adverse drug reaction such as:
  - Serum Sickness/Serum Sickness-Like Reaction
  - DRESS Syndrome
  - Acute Interstitial Nephritis
  - Steven Johnson Syndrome or Toxic Epidermal Necrolysis
  - Hemolytic Anemia

Yes → **Avoid penicillins.** Use alternative drug with appropriate antimicrobial coverage. If there is a very strong clinical indication for use of a penicillin, involve Allergy and Infectious Disease.

No ↓

- Penicillin reaction was immediate-onset (within 2 hours of dose), with features consistent with an IgE-mediated hypersensitivity:
  - Visible swelling of the tongue, lips, uvula, mouth, or eyes
  - Laryngeal edema, stridor, coughing, wheezing, labored breathing
  - Low blood pressure, fainting, anaphylaxis, shock
  - Hives (not isolated; in addition to other symptoms above)
  - Vomiting (not isolated; in addition to other symptoms above)
- Reaction details largely unknown/not recalled but did not involve the mucosa, cause skin desquamation (peeling), or result in organ involvement.

Yes → **Use a 3rd or 4th generation cephalosporin, a carbapenem, or a monobactam (Aztreonam*)** *OR* use an alternative antibiotic. Refer to Allergy clinic at discharge for evaluation of penicillin allergy. If ID consult determines that a penicillin is needed and there are no alternative therapies, consult Allergy.

**Do not use Aztreonam if there is a history of reaction to ceftazidime as these cross react.*

No ↓

- Historical penicillin reaction resulted in hospitalization for monitoring and treatment.
- The patient *currently* has unstable or tenuous hemodynamic or respiratory status, is nonverbal, is pregnant, or seems "high risk" to inpatient medical team for other reasons *(regardless of penicillin reaction history or time elapsed since reaction)*

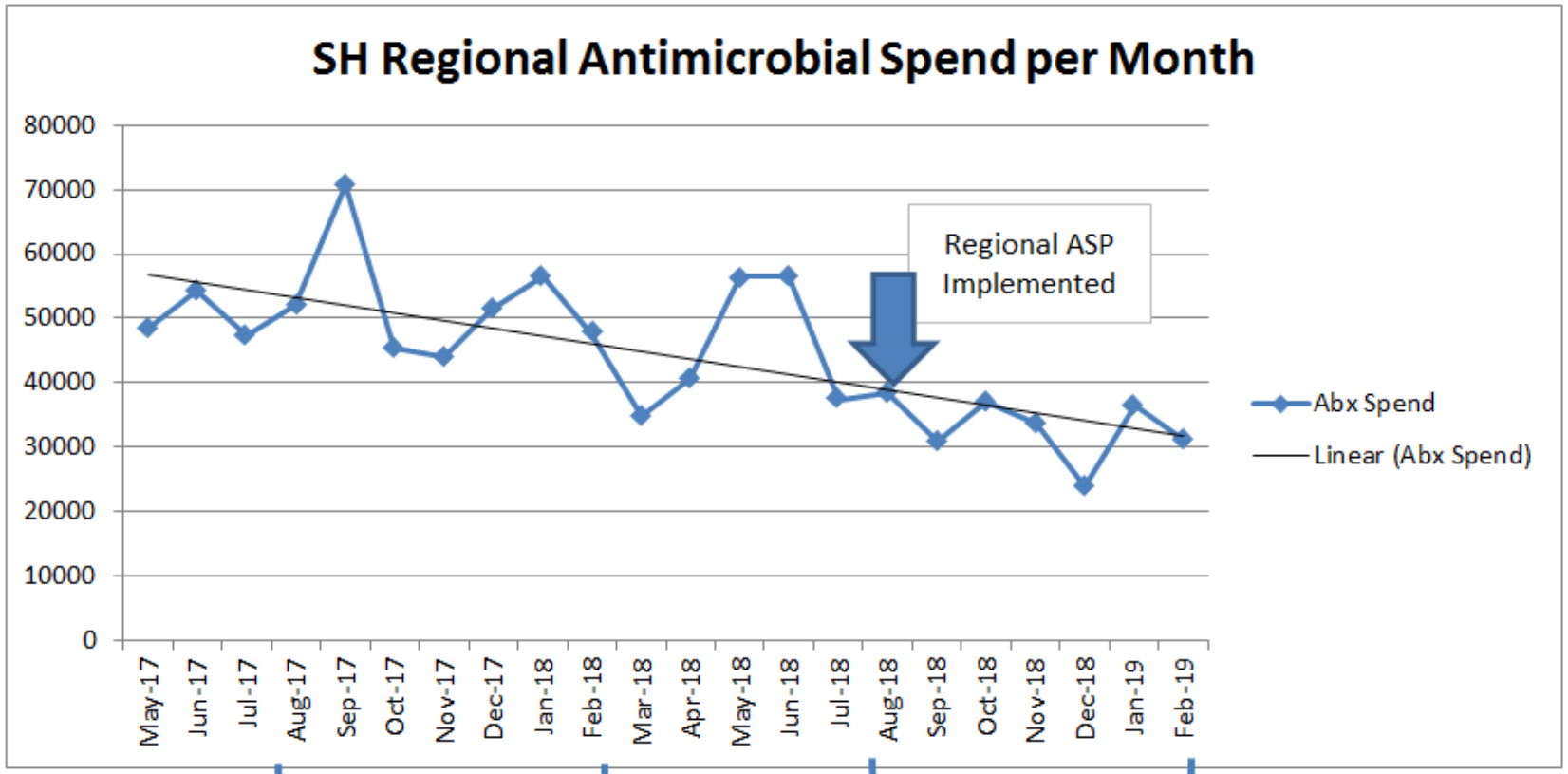
Yes → **Avoid penicillins.** Use alternative drug with appropriate antimicrobial coverage. If there is a strong clinical indication for use of a penicillin, involve Allergy & ID teams.

Penicillin Allergies

How could you improve the documentation of penicillin allergies in your workplace?

Spectrum Health ASP Metrics

- Spectrum Health ASP uses a variety of different metrics
  - Antimicrobial purchasing cost data
  - Healthcare-associated infection rates
    - CLABSI
    - CAUTI
    - CDI
  - NHSN Antimicrobial Use Module
    - Antimicrobial duration of therapy
    - Standardized Antimicrobial Administration Ratio
  - Antimicrobial Stewardship Program intervention documentation

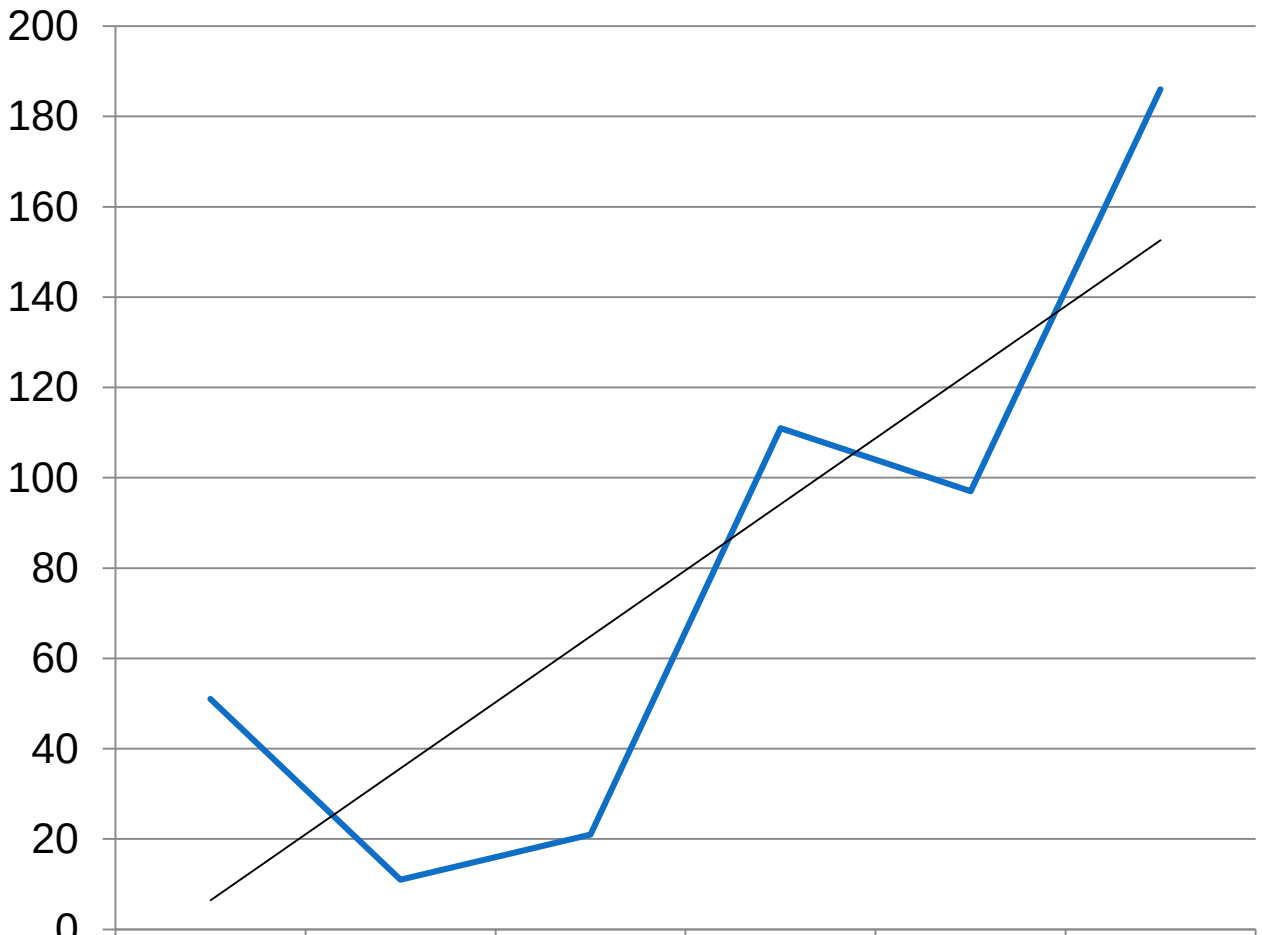


Total: $368,123.11
Average/Month $52,589.02

Total: $231,108.15
Average/Month: $33,015.45

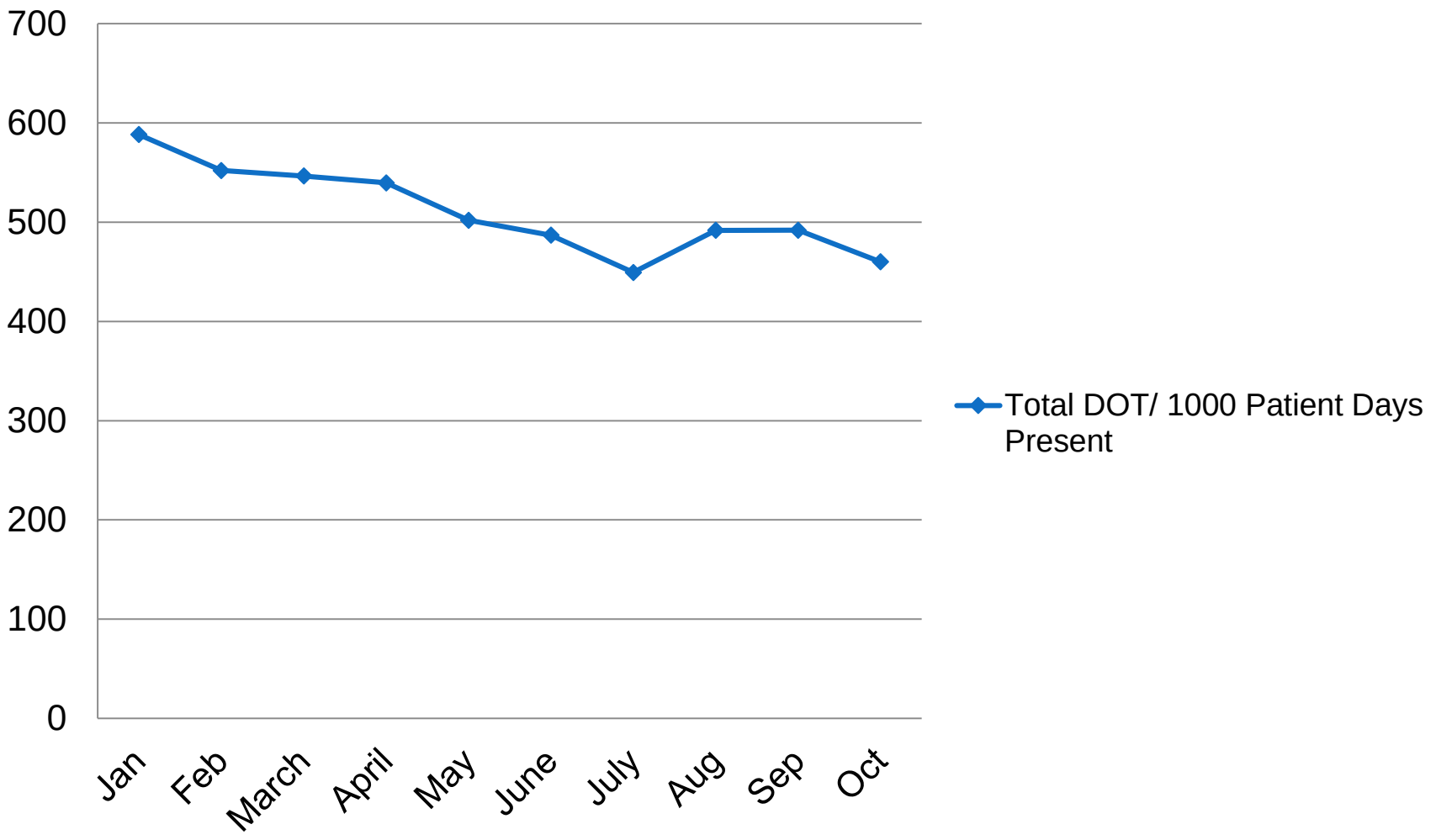
Total: $137,014.96
Average/Month: $19,573.57

Total Number of ASP Interventions in SH Regional Hospitals

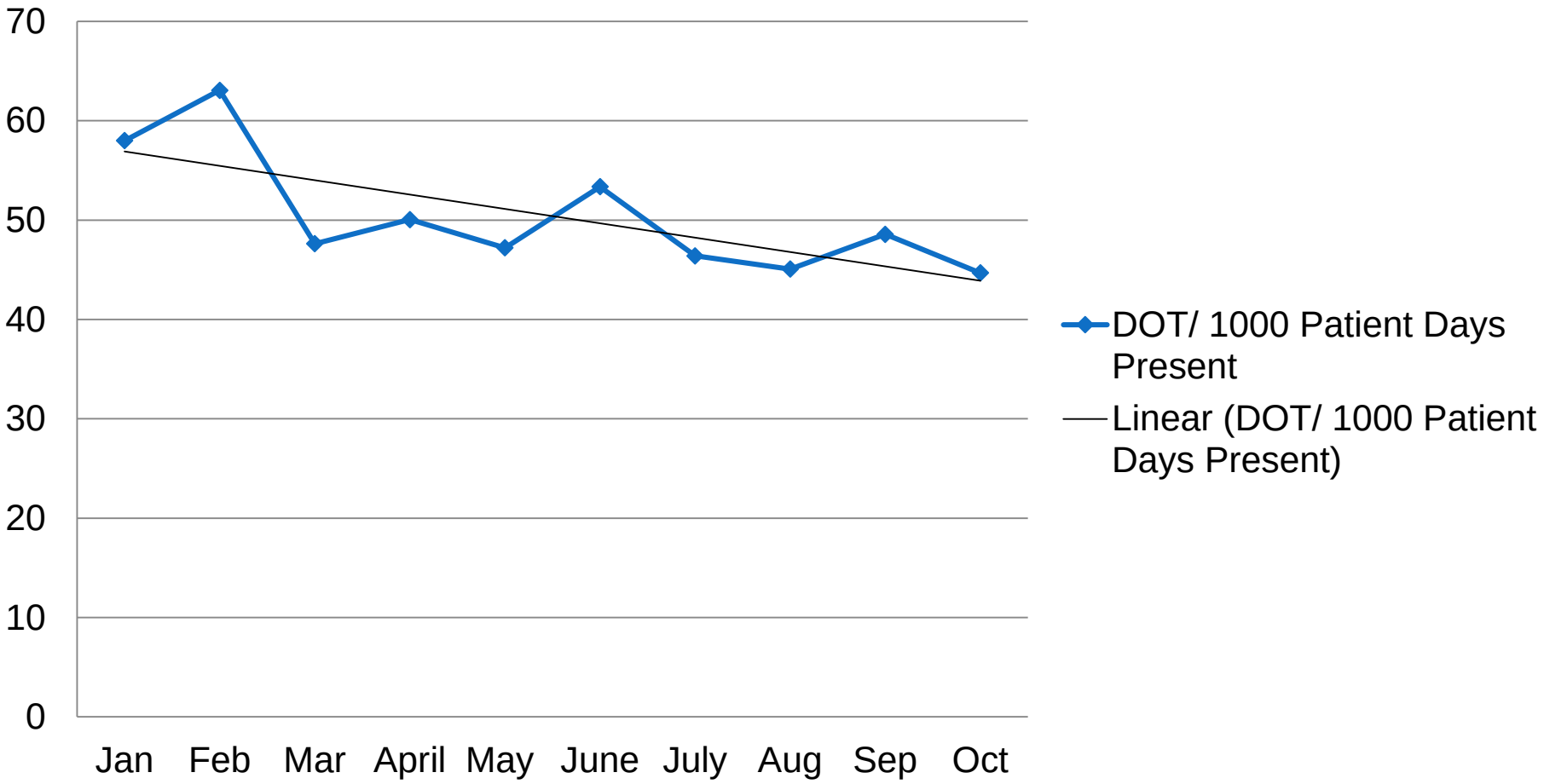


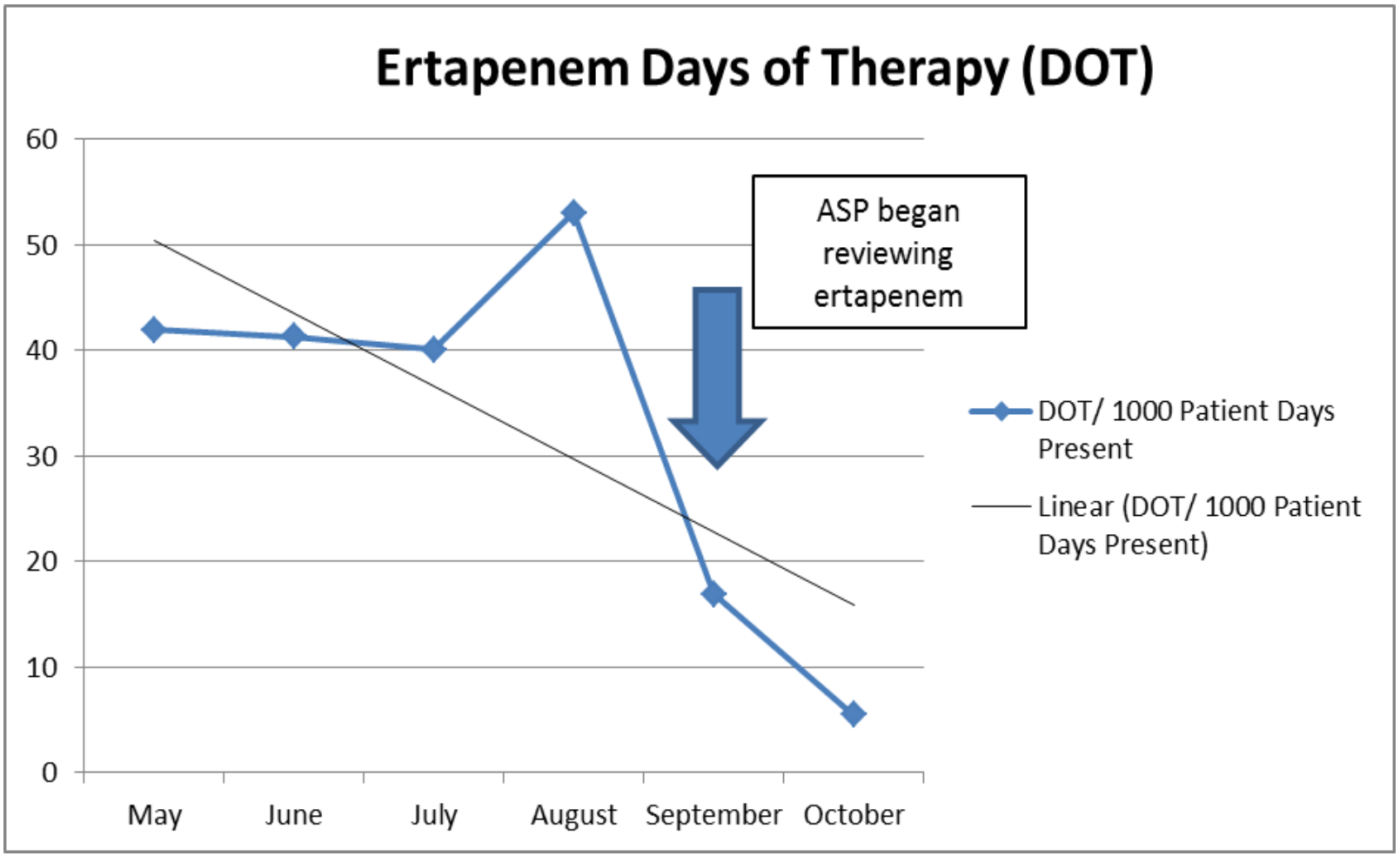
	May	June	July	August	September	October
Regional Total	51	11	21	111	97	186

Antimicrobial Utilization



IV Vancomycin DOT/ 1000 Patient Days Present

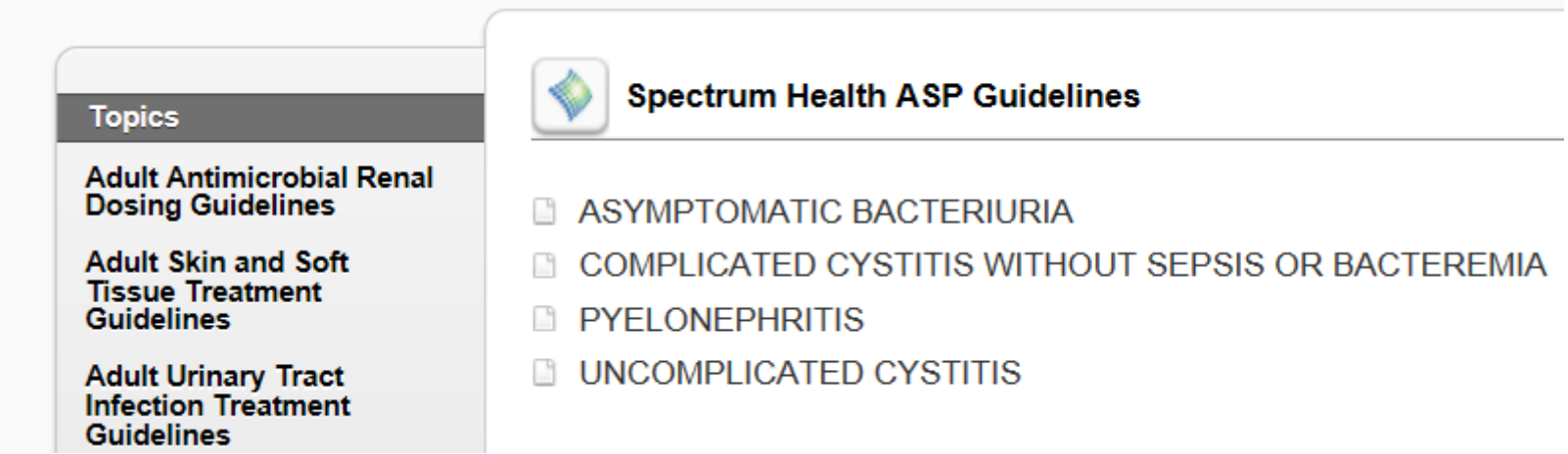



Ertapenem Days of Therapy (DOT)
60
50
40
30
20
10
0
May
June
July
August
September
October
ASP began reviewing ertapenem
DOT/ 1000 Patient Days Present
Linear (DOT/ 1000 Patient Days Present)

Spectrum Health Resources

- Available Resources:
  - Spectrum Health Disease State Treatment Guidelines
  - Antimicrobial Dosing in Special Populations
    - Obesity
    - Renal dysfunction
    - Critically ill
  - Formulary Antimicrobial Cost
  - Antiretroviral Reviews
  - Antimicrobial Therapeutic Drug Monitoring

Spectrum Health Resources



PYELONEPHRITIS

Classification

- Pyelonephritis:
  - Urinary symptoms (below) with systemic signs of infection AND:
    - Urgency
    - Frequency
    - Dysuria
    - Flank or abdominal pain
    - Suprapubic pain or tenderness
  - Pyuria (> 10 WBC on urinalysis) with a positive urine culture for a uropathogen

Empiric Treatment

- Without Sepsis and/or Bacteremia
  - Preferred: Ceftriaxone 1g every 24 hours ± gentamicin if clinically unstable
  - Alternative(s):
    - Ciprofloxacin 400 mg IV every 12 hours* + gentamicin until susceptibility available
- With Sepsis and/or Bacteremia:
  - Preferred: Cefepime 1g every 8 hours* ± gentamicin if clinically unstable
  - Alternative(s):
    - Piperacillin-tazobactam 3.375g every 6 hours* ± gentamicin if clinical unstable

*must be adjusted for renal dysfunction

Treatment Duration

- Without Bacteremia:
  - Patients with rapid improvement: 7 days
  - Patients with delayed response: 10-14 days
- With Bacteremia:
  - Treatment with a fluoroquinolone & patients with rapid improvement: 7 days
  - Treatment with a non-fluoroquinolone & patients with rapid improvement: 7-10 days
  - Patients with delayed response: 10-14 days

Antibiogram

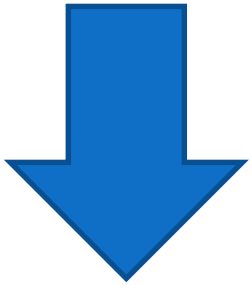
	# of Isolates	Ampicillin $10	Ampicillin-sulbactam $9	Cefazolin $2	Cefepime $7	Ceftazidime $11	Ceftriaxone $2	Ciprofloxacin $5	Clindamycin $19	Erythromycin $7	Gentamicin $5	Levofloxacin** $6	Meropenem $16	Nitrofurantoin* $2	Penicillin $50	Piperacillin-tazobactam $20	Tetracycline $2	Tobramycin $14	TMP-SMX $1	Vancomycin $20
Gram-positive organisms																				
Enterococcus faecalis	95	99											95							99
Enterococcus faecium [a]	24	25																		58
Enterococcus species	77	97										77*		95						100
Staphylococcus epidermidis	35			29					59								86		47	100
Staphylococcus aureus (MSSA)	293			100					80								90		99	100
Staphylococcus aureus (MRSA)	184								52								90		93	100
Streptococcus pneumoniae [a,b]	15						93					100			80					100
Gram-negative organisms																				
Acinetobacter baumanii [a]	14		64			29		57			64		64			38		64		
Citrobacter freundii	34				100		74	97			97		100	96				100	94	
Escherichia coli	480	53	59	87			93	80			91		100	94		93		93	80	
Klebsiella (Enterobacter) aerogenes [a]	21				100		67	100			100		100					100	100	
Klebsiella oxytoca	53		70				94	98			98		100	79		91		98	98	
Klebsiella pneumoniae	146		75	88			90	90			92		97	48		91		92	86	
Proteus mirabilis	87	75	89	88			99	59			90		100			100		93	62	
Pseudomonas aeruginosa	219				87	88		78			94		85			88		98		
Serratia marcescens	30				100	97					97		100					85	100	
Stenotrophomonas maltophilia	36					63						89							94	

Pharmacy Role in LTCF ASPs

- The pharmacist can play a vital role in long-term care antimicrobial stewardship
- Pharmacist Roles:
  - Drug expertise
    - Correct antimicrobial for given indication
    - Dosing optimization
    - Duration optimization
  - Education on clinical guideline adherence
    - Ensuring rapid diagnostic tests are done prior to initiating therapy
  - Policy creation
    - Creating a “criteria for use” for pre-defined antimicrobials

LTCF ASP Example

FDA releases safety warning on the use of fluoroquinolones (FQs) for acute bacterial sinusitis, acute exacerbation of chronic bronchitis, and uncomplicated cystitis



Long-term care facility wants to monitor FQ prescribing to determine if their facilities' usage is optimal

LTCF ASP Example

- Consultant pharmacists document all FQs dispensed within their facility on a monthly basis
  - Facility seems to be overprescribing FQs for uncomplicated cystitis

- Consultant pharmacist gains support from administration and physician champion to implement the following interventions:
  - FQ “criteria for use”
  - Direct provider feedback on inappropriate prescribing
  - Resident family education about the overuse of FQs
  - All findings presented quarterly to interdisciplinary group

LTCF ASP Challenges

- Many potential obstacles exist for antimicrobial stewardship programs in long-term care facilities
  - Metrics
    - What/how to track
    - Reporting tracked metrics
  - Electronic medical record integration/diversity
  - Consultant service
    - Only 1-2 visits to facility per month
    - Difficulty making “prospective” recommendations

Building Stewardship

- Available resources:
  - Michigan Society of Health Systems Pharmacists ASP Webpage:
    - http://www.michiganpharmacists.org/resources/antimicrobial
  - Michigan Antibiotic Resistance Reduction Coalition:
    - http://www.mi-marr.org/provider.php
  - Michigan Department of Health & Human Sevices ASP/ICAR:
    - https://www.michigan.gov/mdhhs/0,5885,7-339-71550_5104_55205-300679--,00.html
  - Centers for Disease Control & Prevention ASP Toolkit:
    - https://www.cdc.gov/antibiotic-use/healthcare/index.html
  - National Quality Forum ASP Practical Playbook:
    - https://store.qualityforum.org/collections/antibiotic-stewardship

Questions

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